SPORT DIVER

JULY/AUGUST 1980

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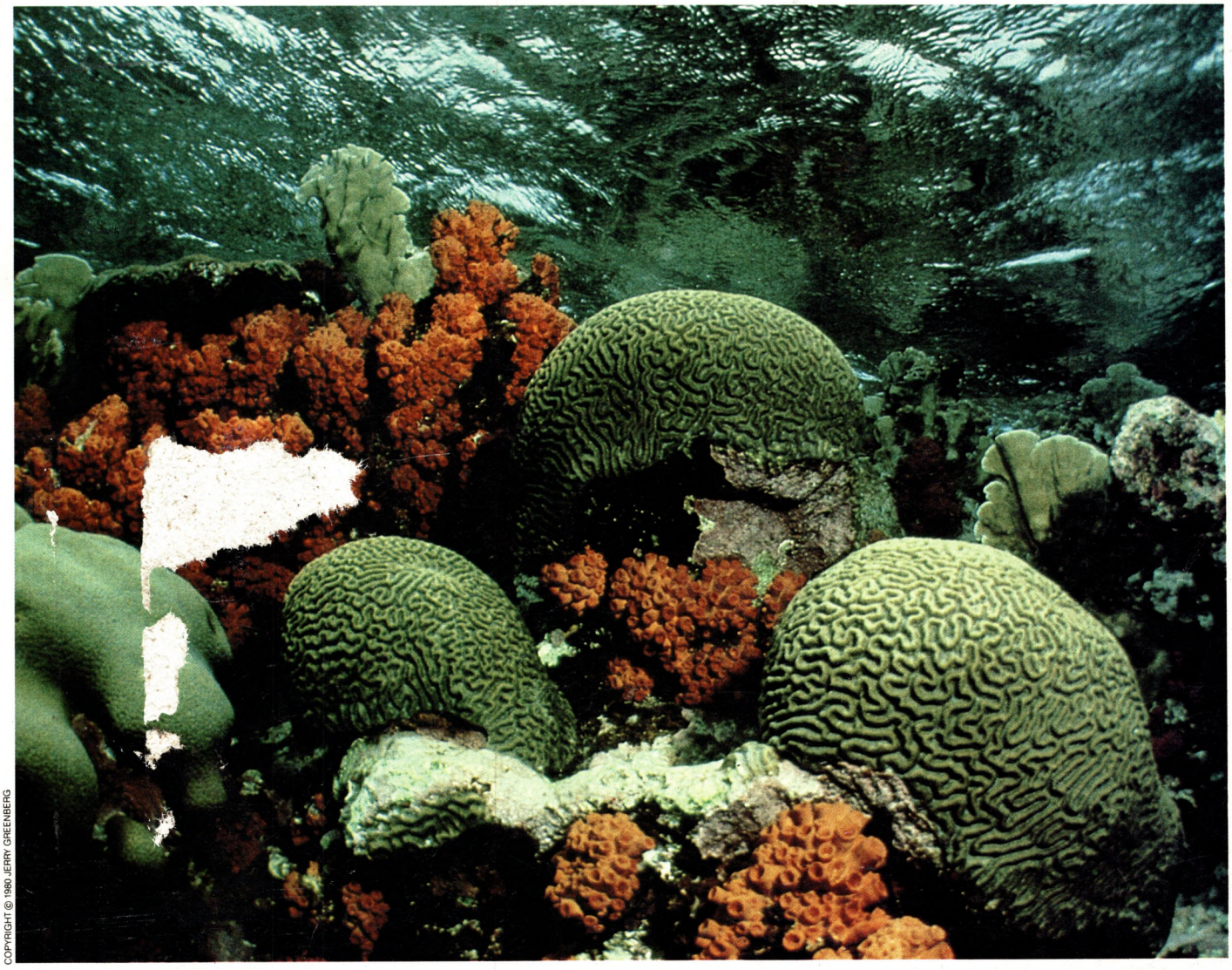

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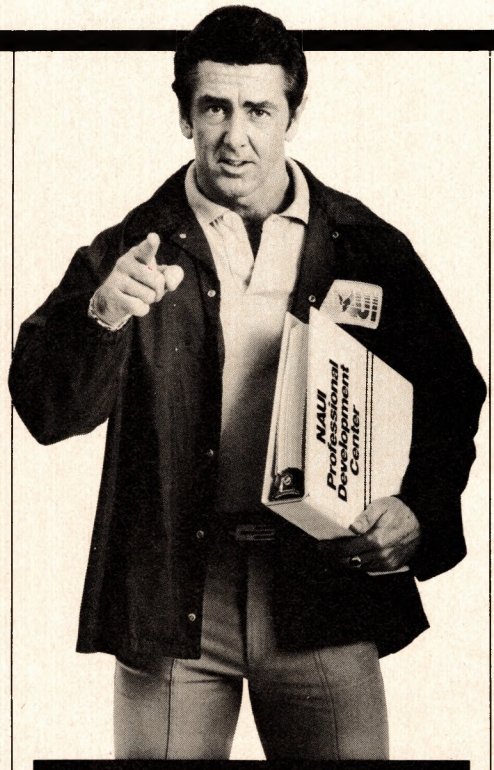

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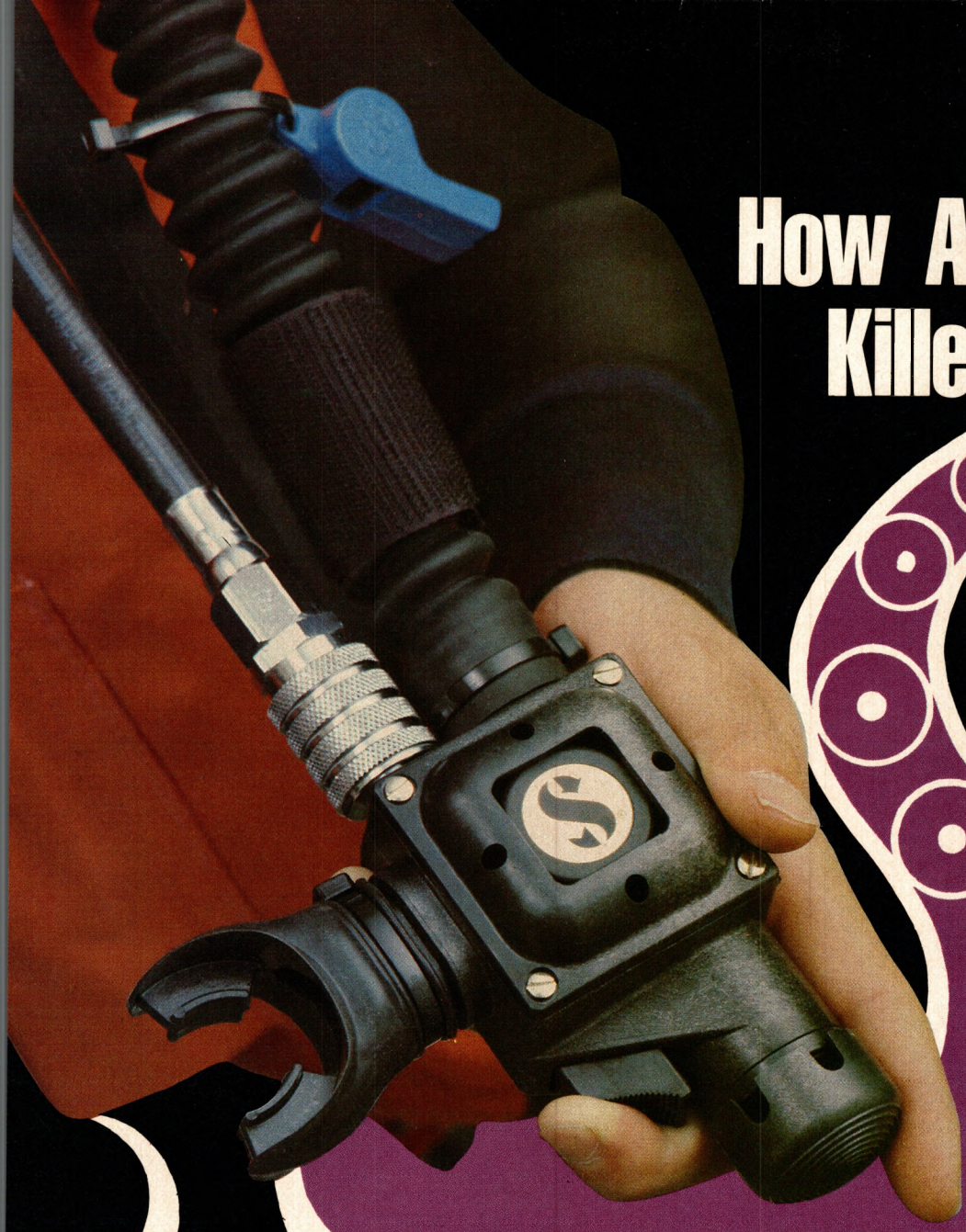

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The Sea of Cortez 90
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John Steinbeck so loved the fragile beauty of this slender sea that he spent almost a year cruising its coastline and immortalized the experience in print. If he'd had tanks and a compressor, he might never have left.

DANIEL GOTSHALL

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BURTON McNEELY

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Cover: Smooth brain coral *Diploria strigosa*, shares the limelight with orange tube coral, *Tubastraea coccinea*, on a shallow reef off Bonaire, Netherlands Antilles. Photo by Jerry Greenberg.

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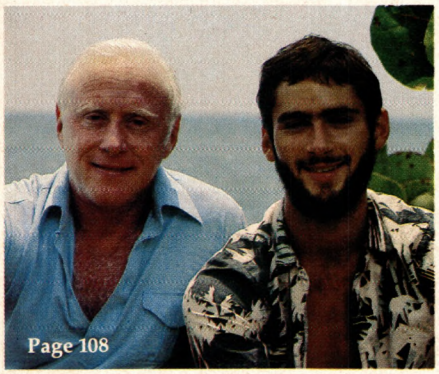

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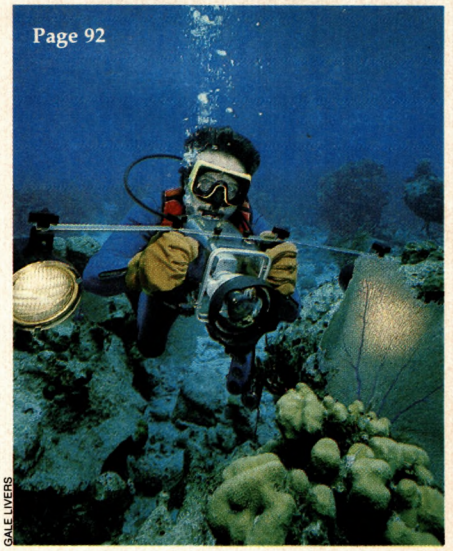

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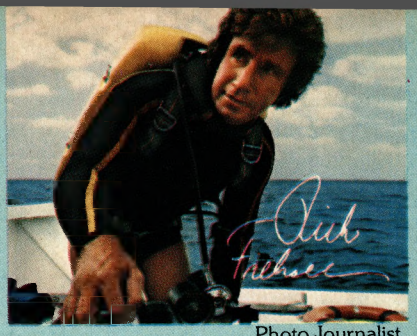

Photo Journalist

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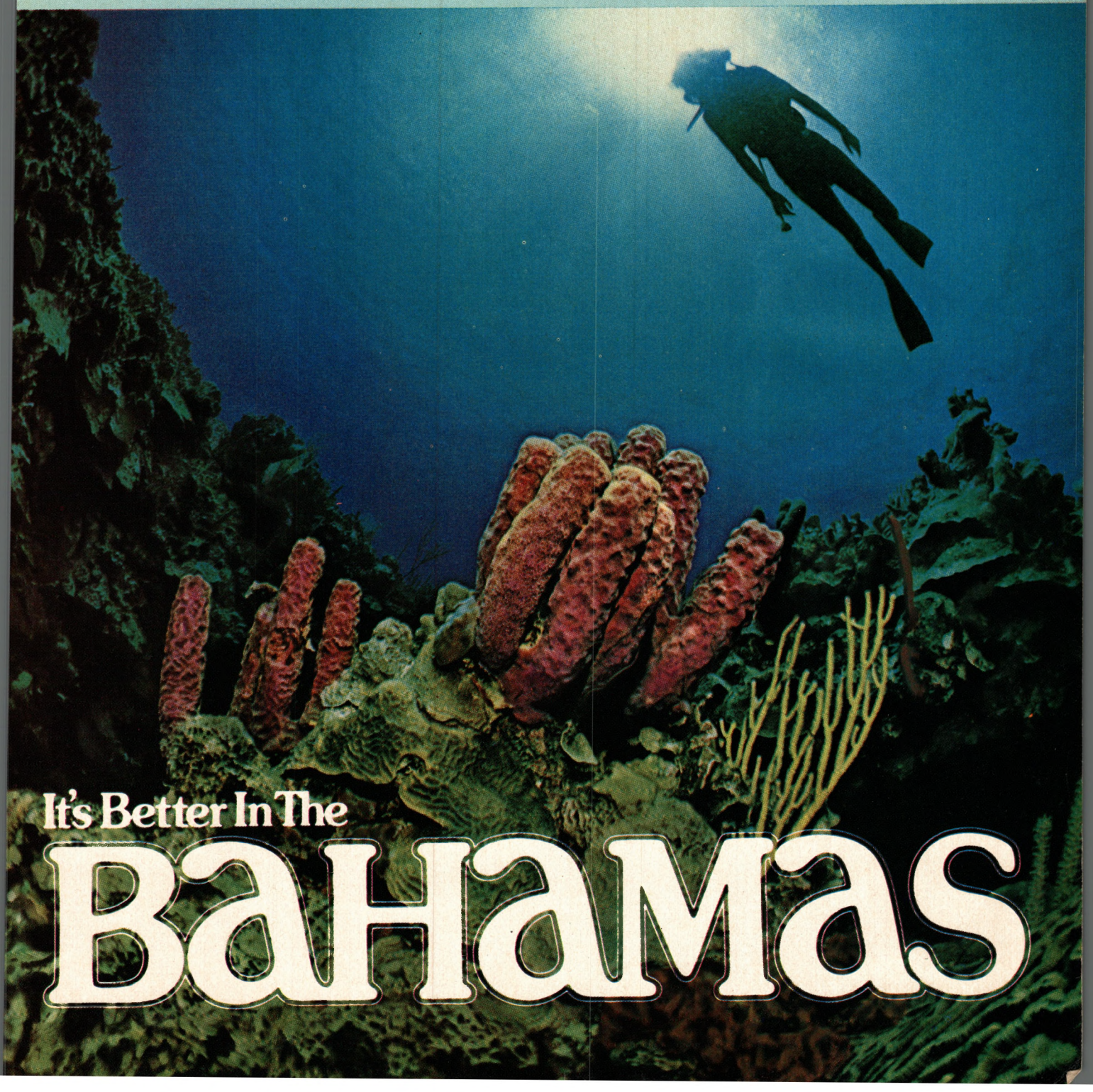

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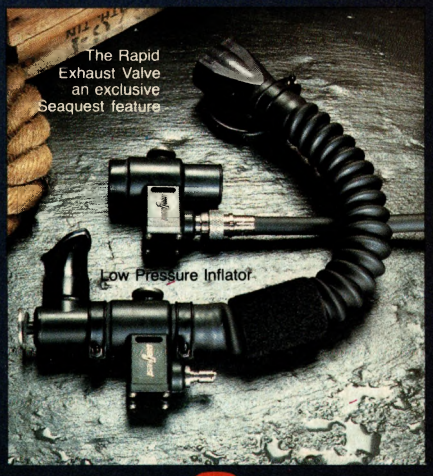

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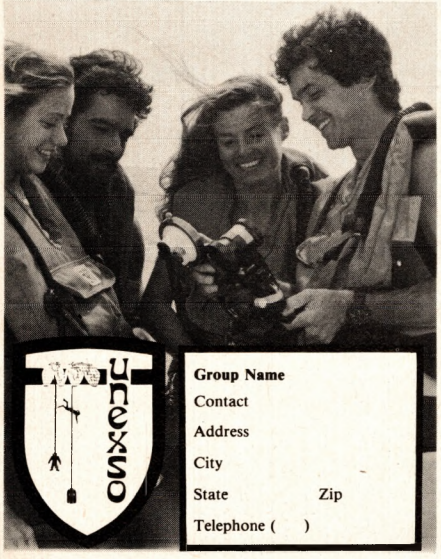

Inside Sport Diver

We carry a small stick.

STEPHEN EARLEY

It's too bad Teddy Roosevelt wasn't a diver. Whatever else he may have been — interventionist, political gadfly, big game hunter — he was above all a man who had a dream; a dream of an America with vast wilderness preserves in which to recharge its soul. When Roosevelt created the National Park System developers complained the president was barring the use of valuable timber land and mineral deposits vital to national growth. Others complained about spending federal money to protect land that was so remote and isolated that few Americans would ever see it. Both were wrong.

Today nobody questions the value of upland preserves because, by the early 1970s, the squabble had moved offshore. In time, underwater parks such as John Pennekamp, Buck Island and the ones at San Diego and Isle Royale (page 97) will be as familiar as Yosemite or Grand Canyon. But unless we find another Roosevelt, the six existing U.S. marine preserves may be the only underwater wilderness left.

The U.S. Congress agreed with the principle of underwater parks when it passed the Marine Protection, Research, and Sanctuaries Act of 1972: "The Secretary of Commerce . . . may designate as Marine Sanctuaries those areas of the ocean waters . . . which he determines necessary for preserving . . . such areas for their conservation, recreational, ecological, or esthetic values."

Unfortunately, those same old economic interests keep interfering with the achievement of this lofty goal. And since the Act was passed in 1972, Congress has repeatedly shown that it is long on sentiment but very short on what it takes to make the program real: Cash and political muscle. The talk these days isn't about the wilderness, it's about "energy independence."

Energy independence, you see, is important to our national health. We must stop sending dollars overseas for OPEC oil. If the oil companies have their way, we'll still pay those inflated prices, but for our own domestic crude. Instead of sending the money to Saudi Arabia we'll send it to the owners of foreign oil companies such as Shell and Phillips or to multi-national conglomerates like Exxon that are only nominally "American."

In return for this independence, the oil companies are asking us to give up a few hectares of "unproductive" ocean bottom. Unfailingly, what they ask for seems to fall into very close conjunction with vital ecosystems: Georges Bank, the Farallon Islands, or Flower Gardens Reef (page 50). In all three of these areas (two are being considered for sanctuary status) the Department of Interior has let contracts that will allow big oil to start punching holes in the substrate. No one claims it holds a lot of oil, but in the crude-crazed 80s, a cupful looks like a lot.

Maybe it's worth it. Maybe we'll run dry if we don't locate every last drop of offshore oil. But someday, when our grandchildren drive to the seashore in their solar/electric cars I know they'll look at our petroleum wasteland with the kind of horror you or I would feel if we saw an oil derrick and a taco stand in Grand Canyon.

And they'll wonder where our Teddy Roosevelts were.

Steve Blount

Steve Blount, Editor

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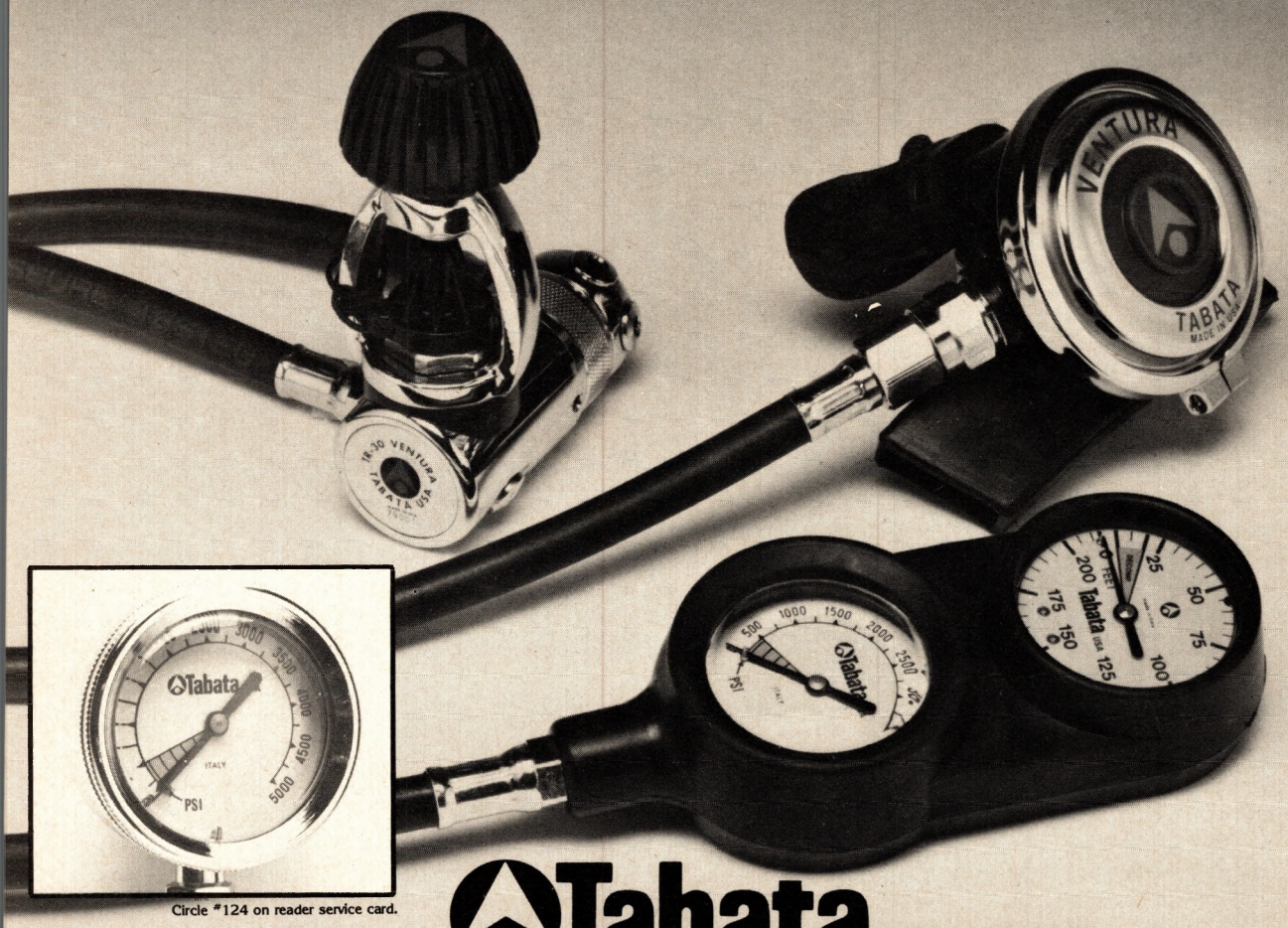

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The Mail

Blasts from the Past

My sincere appreciation for the superb article on our cannon recovery program and shipwreck reconstruction at Pennekamp Park (Jan/Feb 1980).

The underwater exhibit is more than a fascinating attraction for swimmers, snorkelers and sport divers. It is a symbol of the commitment we share—to see that Florida's underwater heritage is preserved, protected and made accessible to everyone.

George Firestone
Secretary of State
Tallahassee, FL

Disaster Within A Disaster

I read with interest your coverage of "The World's Biggest Oil Spill" (Jan/Feb 1980). It is a disaster within a disaster for sport and commercial divers.

I'd like to commend Lowell P. Thomas on a brilliant job. He kept my interest to the last word.

I hope you will have more on the spill in the future. I'm planning to move to the Corpus Christi area for a few months and I'd like to help out in the control and after-effects of the spill. I am a concerned and upset sport diver willing to learn and not afraid of danger.

Brian Surette
Medford, MA

How much oil the oceans can absorb before life systems and the marine food chains are seriously affected is anyone's guess. People who's livelihood and leisure time involves the oceans must voice their concern and support to stop pollution of oil, toxic chemicals, and radiation. They can do this by writing letters; supporting clubs and societies that promote solutions to today's complex environmental problems; staying plugged into the energies of local, state and federal programs that are achieving a cleaner, healthier environment. Most importantly, on a personal basis, practicing a code of ethics that is ecologically sound. We divers must be obligated to protect the underwater world we enjoy.

James Scerra
Hydrologic Technician
Herkimer, NY

Hawaiian Errata

Congrats on an excellent and still-improving magazine. Two small beefs:

1. The darn things getting too heavy to hold for as long as it takes to read.

2. The Hawaiian Destination Data was obsolete when it hit the mail. The islands of Hawaii and Kauai have each had their own recompression facilities, at Kailua and Waimea, respectively, for months.

Charles Brown, MD
Riverside, CA

Ah, the pitfalls of lead time. Just as the Winter issue was being printed in Olive Branch, Mississippi, the Big Island was getting a chamber. But even Kreskin couldn't have guessed that Kauai would get a chamber, since it didn't open until Feb. 1980. Now, for all you obsessive-compulsives who must *have up-to-date data sheets, drag out your Winter 1979 issue, get out your pointiest pencil, turn to page 54 and print:*

Kauai Veterans Memorial Hospital, Waimea, Kauau 808-245-6721.
Then, turn to page 57 and print:
Kona Hospital, Kona, Hawaii 808-961-6022.

That feels better, doesn't it. – Ed.

We were disappointed to find misinformation in your Hawaii story.

On page 50, there is no such fish as the "thinker's butterflyfish." It is the Tinker's butterfly, and it is named for Spencer Wilkie Tinker of the Waikiki Aquarium.

On page 53, the "throng of hairy hermit crabs" is a single large crab in a partridge tun shell.

On page 56, the slipper lobster is not surrounded by "colonies of sea urchins," but by a form of coral, tubastrea.

On page 56, the "fantail triggerfish" is not a triggerfish, but a fantail filefish, a member of the Monacanthidae, rather than the Balistidae family.

Ono Mana Divers
Kauai, HI

Our apologies to Mr. Tinker for a typo that misspelled the fish named in his honor. There is a simpler explanation for your other observations: We were wrong. None of us here are ichthyologists, although when deadline approaches we sometimes try to be. In the future, marine identifications for captions will be verified by Lowell P. Thomas, PhD, professor of marine biology at the Rosenstiel School of the University of Miami. Dr. Thomas' credentials are impeccable – he once thought he was wrong, but was mistaken.–Ed.

Asking Some Deep Questions

I feel "I Learned..." (Winter 1979) was a disservice to sport diving. I am pleased to read that Hal and his buddy now plan their dives and use second stages after their ordeal. But my main concern is that articles like these will tend to make divers believe they can dive to 240 feet.

Patrick Draper
Lynnwood, WA

Mr. Watts, please quit giving my profession and sport a bad name with your mistakes.

David Sherman
Orlando, FL

I do not question Hal Watts' claim of diving to 280 feet on compressed air. However, I'd like to know how he avoided oxygen poisoning due to the partial pressure of oxygen in compressed air. I'm aware that the minimum partial pressure that can cause a toxic effect is not precisely known, but since it usually begins at 280 feet, 380 feet seems to be getting a bit too deep.

Jerry Weaver
Houston, TX

Very little is known about oxygen poisoning in actual diving since most tests are done in chambers under controlled conditions. I made my first deep dive to 270 feet in 1962 and have been diving deeper than 300 feet since. Yes, 380 feet is getting a little deep, but I truly enjoy the feelings I experience at depth. I love the challenge and compare it to auto racing, sky-diving or mountain climbing. I do not recommend it to just anyone, nor do I condone deep diving for others. I have dived below 300 feet under the best safety precautions and on none of these controlled, planned dives have any of the divers "failed the final test" by not ascending alive. Accidents usually occur when "unqualified" divers try to extend

continued

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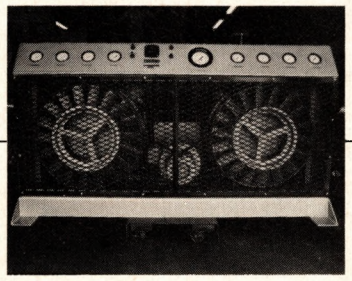

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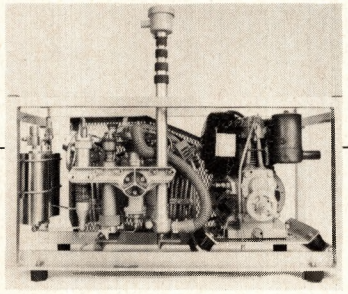

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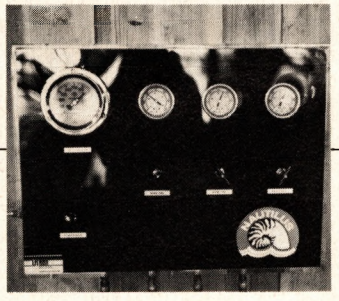

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their depth without proper training and more than adequate equipment. –Hal Watts

Winner by Default

I'd like to compliment you on your March/April issue. I picked up the magazine at the Miami International Airport by default, having read most everything else on the shelf.

On the plane back to Orlando I was amazed at the high quality of the publication, from writing through photography and printing. A beautiful job.

I especially enjoyed Phil Trupp's piece on the Virgin Islands. His writing is as good as anything I've seen in any magazine this year. And the combination of layout and photography make a stunning package.

Erik Calonius
Florida Trend Magazine
Tampa, FL

Piracy: Alive or Dead?

At first glance at your great cover I was quite impressed with your March/April issue. But inside I found a new type of article which should be titled "Factless Tripe" by Phil Trupp. "Shadow of a rifle stock," *Bull*! Just the kind of promotion the charter business needs.

The article concerning hijacking is no credit to your magazine. It does not promote diving or travel, and further is filled with sensationalism and hearsay.

Tom Guarino
Captain, *Sea Fever*
Key Largo, FL

I have lived in Florida and have been diving the East Coast of Florida and the Bahamas for 18 years. I find your article misleading, for I have never, nor has my captain, with 40 years experience cruising the Bahamas, had any encounter with would-be pirates, nor has anyone I know of. I know there is a great deal of drug smuggling and the great number of these smugglers being caught is a matter of record. The U.S. Coast Guard and the Bahamian government both have patrol boats checking vessels for violations and the U.S. Customs office also has planes flying the Bahamas looking for suspicious happenings. I don't say a hijacking is not possible, but it is difficult and almost non-existent. I suggest you do a little more research and let people know about the patrols that do exist. Your article has a tendency to scare a person who might be thinking about cruising the

Bahamas for a vacation and that would be a shame, because there is no better or safer way to see the Bahamas.

We do wish to be prepared, so I would like Phil Trupp to accompany us and he can stand watch with a pea shooter and sling shot on the bow of the *Impossible Dream*. These two weapons should be ample to repel all pirates that may have a desire to hijack our boat.

Dan Wagner
President, SVI
Melbourne, FL

The column on modern piracy wasn't written to frighten readers and/or kill off the charter business. Based on more than two years of travel, research and interviews, the article is strictly informative, accurate *and mildly understated as all blood and guts stories must be.*

Like it or not, piracy exists.

I should point out, however, that no dive boat in this hemisphere has ever been hijacked. Most of them are too big, too fast, and generally well prepared to handle trouble. The odds of Mr. Guarino's boat being taken at sea are incredibly small.

Mr. Wagner, on the other hand, has made a good point: a lot of piracy is mainlined into drug smuggling. And the practice is growing, despite the Coast Guard's embarrassment.

As pointed out in the column, typical victims are weekend sailors, naive yatchsmen, boaters foolish enough to sail unthinkingly into dangerous waters. And there are a lot more of them than you might imagine. But a few simple precautions should keep you out of danger:

1. Don't be the only sail in sight, especially at a night anchorage.

2. Don't make a display of being open to attack.

3. Keep a flare gun on board and don't hesitate to use it if a strange vessel makes aggressive moves.

4. Don't sail unwary into waters known for crimes at sea, such as the Bahama Banks and the Colombian Coast. Be alert not paranoid. –Phil Trupp

Editor's Note: Credit for the opening photo of "The Shark Catchers" (May/June 1980), page 142, was inadvertently omitted. It should read: Sea World's Shark Institute.

Please send all correspondence for this column to: The Mail, c/o *Sport Diver* Magazine, Suite 250, 444 Brickell Ave., Miami, FL 33131.

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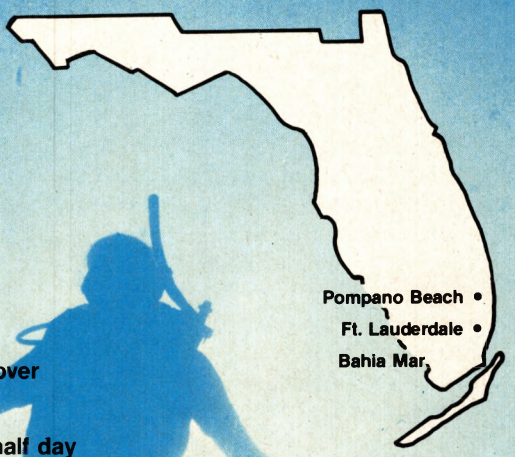

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Photo: Gary Hytha

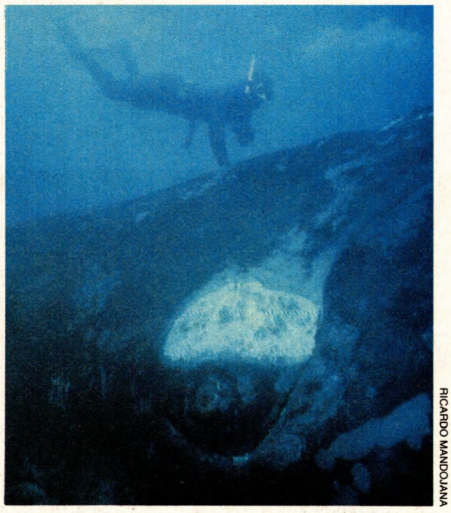
Richard Ellis

Diving with right whales.

We stopped the boat 200 yards from the whales not wanting to disturb them with the sound of the engine. A mother and her 20-foot calf were lounging at the surface. We watched as the mother rose to breathe, exhaling twin plumes of spray as she raised her blowholes above the surface. The baby was more energetic, rolling over to show his piebald black and white belly, or poking a flipper or fluke out of the water. We quietly eased over the side. We wore full wetsuits — the water temperature was about 45 degrees — mask and snorkel. We decided not to use scuba gear because we assumed contact with the whales would occur near the surface. In these shallow waters the whales could not dive deeply, and we wanted to be as mobile as possible. As we swam towards the whales, we had to keep them in sight from the surface. The water was fairly clear and the sun shining, but underwater we would not be able to see the whales until we were almost upon them. I heard an explosive "whoosh" as the mother breathed out and then a lesser version as the baby exhaled.

The first sight of a whale underwater is breathtaking. At first I saw nothing but cloudy green; then a vague, dark shadow emerged from the flickering gloom. The shadow took shape as I got closer, revealing itself to be two gigantic tails undulating gently as the whales maintained their positions. The tail of the larger whale was a huge, gracefully curved horizontal plane, perhaps 18 feet across, and the baby's was half that size. As I swam into range, I drifted over the tail of the calf, propelled as much by my enthusiasm as by my momentum. I tried to brake before I got too close, but I was carried over the smaller whale's flukes. As I brought my legs up to avoid contact the tail slowly rose and gently brushed against me. The calf did not know I was there, and the contact was a great surprise to both of us. The whale kicked its flukes downward giving it a forward thrust which created such turbulence that it tumbled me over and I watched the whales disappear into the swirling sand. Our first right whales were soon out of sight. For such large animals that have to breathe regularly at the surface, right whales have an uncanny ability to disappear.

Because they are so large and slow moving, the first impression one gets of



RICARDO MANDOJANA

a whale underwater is not unlike a London bus emerging from a dense fog. It soon becomes clearer, and you can identify the details of the callosities, eyes and flippers, but it inexorably moves past, a bus that will not stop. They never appear to move rapidly, but they can easily outdistance a human swimmer. When diving with a single whale, we saw it approach slowly — and after coming within five feet of us, it dipped its calloused snout and majestically passed beneath us. We saw the tightly-closed blowholes, the expanse of fin-less back, and the broad black flukes gracefully flexing as they powered the whale into the enveloping green shadows.

Right whales have few natural enemies — there are a couple of reports of killer whale attacks — and their natural curiosity and inoffensiveness make them ideal diving companions. One is always asked if it isn't dangerous to dive with such enormous creatures. The first time *National Geographic* photographer Bill Curtsinger encountered a Patagonian right whale, he was "threatened" by a side-to-side head movement (similar behavior was observed by Peter Beamish diving with a humpback whale in Newfoundland), but Curtsinger got out of the water with no harm done.

It is the inoffensive curiosity of the right whales that probably contributed to their world-wide demise. Of course, they were the "right" whales to kill, since they provided plentiful oil and baleen, they floated when they were killed, and their lack of speed made them easy to approach and dispatch. When the Pilgrims landed in Massachusetts they found right whales plentiful in the inshore waters. On a single day in 1700, 29 right whales were killed in Cape Cod Bay; by the middle of the 18th century they had become so rare in New England waters that the mere sighting of a right whale was newsworthy.

By the beginning of the 19th century the North Pacific population of right whales was also reduced to a few hundred animals, and mass predation produced similar results among South African and Australian populations. Only the Patagonian population exists today in anything approaching significant numbers, and these whales are fully protected when they are in Argentine waters. Right whales are considered endangered throughout the world, and no whaling nation has been allowed to hunt this species for more than 40 years. Despite this protection the species has not recovered, and the animal still hovers on the brink of extinction.

Wherever the right whales congregated in previous years they congregate no longer. Fortunately for the whales, their last refuge, Peninsula Valdés, is an inaccessible outpost where the remnants of a once-plentiful race of giants can still find the necessary isolation and peace for propagation of their kind.

Richard Ellis is a writer and illustrator whose world is natural history. His lastest book, ***The Book of Whales*** *will be published later this year.*

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Lowell Weicker

Dumping nuclear waste into the sea.

For 25 years, from 1946 to 1971, the old Atomic Energy Commission authorized disposal of nuclear wastes in the ocean. Radioactive debris was placed in 55-gallon drums and dumped into the sea. The fate of most of these drums is still unknown today.

By the time ocean dumping of radioactive waste was halted in 1971, approximately 75,000 drums, and the reactor pressure vessel of the nuclear submarine *Seawolf*, had been dumped into the sea off the nation's coasts.

The Atomic Energy Commission had much to learn about the safe handling of radioactive waste then, and even more to learn about the processes of the deep ocean and the fate of the wastes sealed in those drums. The sad fact is that the instant those drums splashed into the sea it was too late to respond to any harmful effects they might cause.

Currently, Title I of the Marine Protection, Research and Sanctuaries Act of 1972 prohibits the dumping of high-level radioactive wastes in U.S. waters, and the dumping of low-level wastes into U.S. waters requires a permit from the Environmental Protection Agency. In international waters, the dumping of high-level radioactive wastes is prohibited by the 1972 Convention on the Prevention of Marine Pollution by Dumping of Wastes.

The convention also directed the International Atomic Energy Agency to develop regulations on the ocean disposal of other radioactive wastes not considered to contain high-level radioactivity. However, the definitions of high-level wastes contained in these documents do not cover all potentially dangerous wastes. Classifying radioactive wastes is extremely complex, and many of the existing regulations tend to be overly simplistic. An excellent example of poorly defined radioactive waste is the water now flooding the Three Mile Island reactor building. Although extremely hazardous, the water does not qualify as high-level waste under the definition in the Marine Protection, Research and Sanctuaries Act.

On July 16, 1979, I offered an amendment to the Nuclear Regulatory Commission (a successor to the Atomic Energy Commission) Authorization Bill which would put a one-year moratorium on the dumping of any radioactive wastes in the ocean. The Senate passed the legislation, and it is now being considered in a conference committee in the House of Representatives.

Nobody wants radioactive waste in the neighborhood, but some want to dump it into the oceans.

Although no nuclear wastes of any level have been dumped into the oceans since 1971, the shrinking availability of disposal sites will surely make the oceans enticing in the near future.

There is a movement in this nation to end all nuclear power generation. Many believe that this will solve our nuclear waste problems, but this is not so. There are already thousands of tons of radioactive waste in temporary storage sites which must be disposed of eventually. Furthermore, until alternative energy sources are developed, we will depend on existing nuclear power plants for a significant amount of energy. We must dispose of the 10,000 cubic feet of waste they generate annually, whether we like it or not.

One of the primary responsibilities of government is the conservation and responsible management of the nation's resources for future generations. The oceans are one of the greatest resources of this nation, indeed of this planet. If we are going to protect this vital resource we cannot afford to casually dump wastes into the sea. Not until after a careful evaluation of alternative disposal methods can a decision be made on the best method of nuclear waste disposal.

Recent events at Three Mile Island have caused a new public awareness about nuclear waste disposal. People are becoming increasingly reluctant to allow dump sites in their neighborhoods. With several of the existing land-based radioactive dumpsites closed and nuclear power plants running out of on-site disposal capabilities, there is pressure for a quick decision on new dump sites.

The concept of dumping radioactive wastes in the ocean is still being researched. A new concept of waste disposal known as projectile emplacement in the deep sea sediments is now being studied. Large, free-falling projectiles would be loaded with six to ten drums of solid waste and released from ships over the great sedimentary plains within the mid-ocean gyres. The gyres are enormous circular currents of the oceans whose centers are characterized by their lack of current and which overlie areas of the ocean floor noted for geologic stability. The projectiles would fall through the water column at high speeds, penetrating deep into the sediments and burying the wastes for all time. The concept is still theoretical, however, and there needs to be more research on its long-term effects.

One day it may be demonstrated that projectile emplacement is the best radioactive waste disposal alternative available. A May 1979 report by the Nuclear Regulatory Commission stated, however, "...ocean disposal concepts appear to be the least viable;" certainly they are the least understood.

As the search for safe permanent radioactive waste disposal sites continues, we must keep the future of the oceans and mankind in mind. We may be asking future generations to pay the consequences.

Senator Lowell Weicker (R-Conn.) is a concerned diver who has spent time in the Hydro-Lab. He is a member of the Marine Resources Committee of the U.S. Senate.

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Tim Cahill

Learning how to write real good.

A dirty New York rain pelted the penthouse windows, and I sat on an expensive leather sofa as my publisher explained why the book I had submitted would not sell. "Not presently commercial," is the way he put it.

An hour later I was back out on the street looking for a bar and dodging panhandlers, winos, muggers, bag ladies and assorted perverts. My book had contained several chapters devoted to scuba diving and, near the end, my characters are assembled at an unnamed lake in northeastern Peru. Forty feet under those dark waters is an old Inca treasure, a golden chain weighing 10,000 pounds. Such a treasure actually exists — it is a matter of historical fact — and it has never been found.

The chapters about salvaging the chain are based on experience, and on sustained research. The reader learns about high-altitude diving, salvage techniques, and portable compressors and generators. Everything is accurate, right on down to the description of the lake, where I camped during my South American explorations.

But something was wrong with the idea: so said my publisher. Additionally, I had already accepted and spent a substantial advance, which I now owed the publisher if I couldn't come up with a commercial book idea. It occurred to me that I would soon be joining the bag ladies and winos — a life wasted dodging my publisher — unless I could get a fix on what makes bestsellers.

Which is how I came to purchase a copy of *Overload*, the best-selling novel by Arthur Hailey. The book is about the trials and tribulations of a public utilities vice-president in California who goes to bed with all sorts of women, including a paraplegic and the extremely recently widowed wife of his best friend. One of the vice-president's problems is that a terrorist named Georgos keeps blowing up installations and employees. Near the end of the book, Georgos attempts to blow up a big generating plant, by donning scuba gear and entering the pump house from the river.

So, it suddenly seemed, information about diving is not necessarily the commercial kiss of death in a novel. Unfortunately, the information was not entirely accurate. For instance, we are told that Georgos has a tank filled with "an hour's air supply." I don't know about this. I usually fill my tank with 2300 pounds per

square inch, and how long it lasts depends entirely on how deep and how hard I work. But, Hailey tells us, Georgos learned to dive from underwater demolition experts in a terrorist camp in Cuba. Maybe they do things differently there. "Buenas dias, Señor Comrade. Please give me one hour and 23 minutes' worth of air, hokay?"

Secondly, the terrorist dons a wetsuit and loads *eight* bombs into a small boat and paddles down the river toward the generating plant on a "warm and sunny day." Now, I have personally put on a wetsuit, gone back to get something in my car, and nearly passed out from heat prostration. A diver who loaded all that stuff and paddled for any length of time would collapse long before he could set off his bombs.

The last thing that bothers me about this scene in *Overload* is not research related; it is the writing itself. Georgos misjudges the power of the pump. He is sucked directly into it. "Then," writes Hailey, "the pump impeller blades, seven feet across, seized him and chopped him into little pieces." It seems a tame description, to describe the fate of a guy who has killed half a dozen people, some quite horribly. Hailey should have been more graphic. There are several good words for what happened to Georgos just below the buttons on my Waring blender. Hailey might have said, "Georgos was blended, mixed, chopped, grated and puréed."

Worse, this prosaic description reminded me of the earlier death of one of Georgos' victims whom I thought had been "blown to bits" by a bomb. Checking back, I discovered the character, Art Romeo, had been "blown to pieces" by the bomb. There are pieces of people flying all through *Overload*, and it gets a bit redundant. Hailey might have avoided the repetition with a graceful circumlocution. How about: "Art Romeo departed for eternity in all directions at once."

Despite the problems I had with *Overload*, it did teach me about commercial novels. The hero should be a man ensconced in a crushingly boring job and he should have lots of truly strange sexual experiences. Any information about scuba diving should be as inaccurate as possible. Minor characters must be chopped to pieces and blown to bits. The more the merrier.

I am currently working on a book about a shoe clerk in Sheboygan who falls in love with a graceful young ewe — "my little lambikins" — during a Sunday drive in the country. Tragically, the sheep is chopped to bits by a McCormick threshing machine. In despair, the shoe clerk buys a scuba tank filled with "50 years' worth of air," to spend his life underwater, out of sight of threshing machines. He falls in love with a gorgeous and sympathetic octopus ("your caressing tentacles thrill me so") but they are sucked into the blades of an atomic submarine and "chopped to bits." The submarine captain, assuming he has been attacked, launches his warhead. Destination: Moscow. Everyone in the world is "blown to bits."

Sounds commercial to me.

Tim Cahill was last seen in Oregon covering the eruption of Mt. St. Helens. We hope he hasn't been blown to bits.

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Letter From

...Washington.

BY PHIL TRUPP

The gamesmanship of disaster is as deadly as the disaster itself.

Consider, for example, the *Ixtoc I* oil spill which began last June in the Bay of Campeche off the west coast of Mexico's Yucatan Peninsula.

With good cause it has been called the worst man-made disaster of the century, on a par with Hiroshima in its future implications and short-term environmental impacts. *Ixtoc* blasted megatons of crude oil into the Gulf of Mexico—enough to threaten a quarter of the U.S. coastline. By now the stuff is probably in the food chain; you may be eating it for dinner.

Some of the best off-shore engineers in the hemisphere rushed to the Bay of Campeche hoping to stop the flow of oil 12,000 feet below the surface. It was like trying to cap an underwater volcano.

What really happened out there on that Mexican oil rig—the human factor—waits for a novelist, or Hollywood. In the meantime, however, most of our information has come from Pemex, the Mexican national oil monopoly responsible for *Ixtoc*.

At this point the game truly begins.

Move No. 1: Pemex reports to the world press that *Ixtoc* is spilling 30,000 barrels a day. Several weeks later Pemex claims to have cut the flow to 2000 barrels a day.

Most of us accepted the news; it eased our discomfort with the notion that the *Ixtoc* oil well was out of control.

Score two points for Pemex.

Move No. 2: A congressional investigating team in Washington alleges that Pemex knowingly issued false statistics. They claim the well spilled 55,000 barrels a day, nearly twice what Pemex had claimed. What is even worse, they say, is that Pemex failed to reduce the rate of spill by so much as a barrel. The crude just kept on spilling.

Pemex had no counterattack. It blushed in private and said nothing to refute the findings.

The game became a stand-off. The investigators sent a report to the White House, along with a detailed analysis of the possible economic and environmental impacts.

As in chess, the players were now in action and the game would draw blood.

Move No. 3: President Carter plays

RO SHEFFE

diplomat. With so much tension in the Middle East, it is unwise to embarrass a friendly, nearby oil-producing nation.

Mr. Carter is also sensitive in an election year to the power of Texas Governor W.P. Clements whose company, Sedco, leased the *Ixtoc* drilling rig to Pemex. The President says nothing as Governor Clements scoffs at the advancing oil slick on its way to Texas. It's "much ado about nothing," he says, reassuring Pemex that the U.S. isn't going to sue for reparations.

Move No. 4: President Carter and Mexico's President Jose Lopez Portillo, cover themselves by coming to a gentlemens' agreement. Nothing on paper, of course. They simply tell the press that, certainly, they're worried about *Ixtoc*, and they don't want another disaster. After the mess is cleaned up, they'll discuss a mutual aid deal, the details of which must be negotiated.

At this point, the game is over. The goal is accomplished: Pemex is happy; Governor Clements is happy; Mexico is happy; the congressional findings are skillfully brushed aside: Sure, *Ixtoc* is hell, but international relations require a cool head.

When the Coast Guard releases a report this year along with a request for $1 billion in new clean up and pollution-fighting equipment, the dollar figure will be openly attacked by Administration experts who will say the two million barrels of crude dumped in the oceans each year (not counting *Ixtoc*) do not pose a serious, life-threatening disaster. And besides, everyone's bored after *Ixtoc*. Nothing happening in the Green Room. There's no reason to play that game again!

A few hardened political observers say the disaster game isn't as futile as I have made it out to be; they say it's only a part of some larger design. I don't agree. *Ixtoc* proved the disaster game cannot go on any longer.

A dedication to petroleum energy brings with it a large element of risk—a risk requiring a global response. And, since the White House hasn't found a way to get it, I wish to offer a proposal: formation of an industry/government-sponsored "war chest" dedicated to environmental matters and a new generation of data and technology for the off-shore oil explorers.

The organization would be based on mutual alliance and reliance, and it would seek membership from nations within our sphere of interest. It would replace the gamesmanship with positive, action-directed cooperation. The members would fund the war chest itself, which would be used to achieve any number of goals.

One of the first should be a study of the interaction of crude petroleum and saltwater. Exactly what happens when the two mix is still something of a mystery. There are scientists who say photo and microbial oxidation of the crude winds up as a carcinogenic meal on your table; others claim seawater renders it virtually harmless.

Another aim of the war chest would be joint sponsorship of a study of deep seabed oil drilling. A research and de-

continued

Phil Trupp is ***Sport Diver****'s Washington connection. An experienced author and diver, Phil has spent 20 years covering the Washington scene for major publications.*

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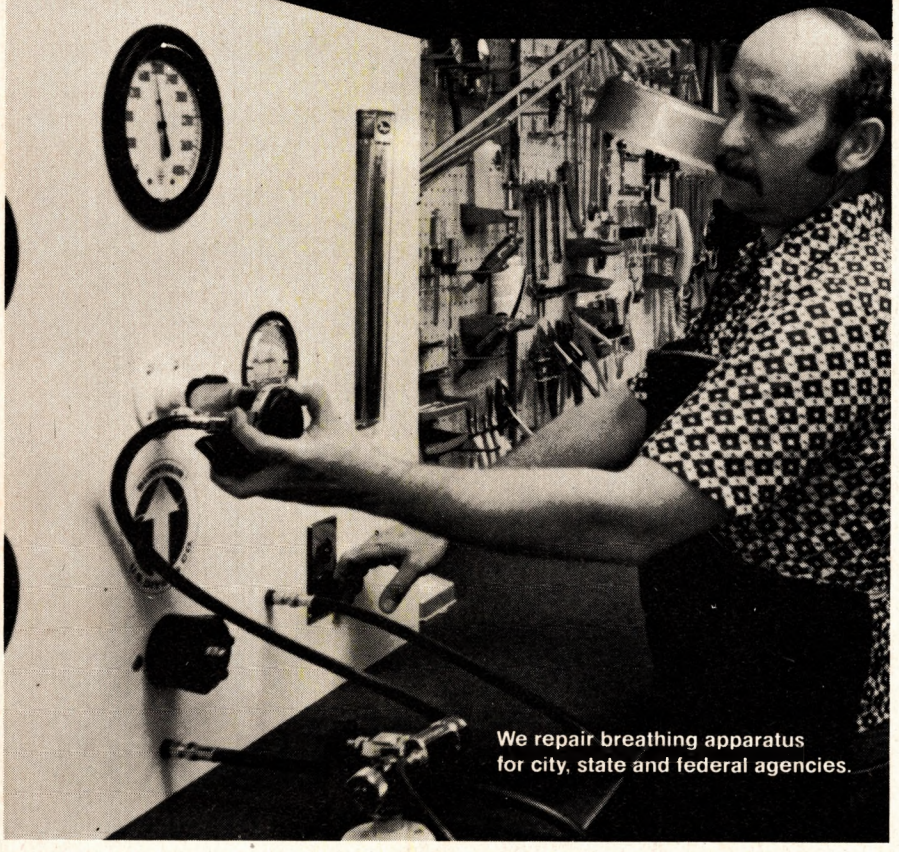

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velopment project, coupled with technology sharing, may prevent another *Ixtoc*.

Foreign oil producers and government representatives would be invited to join the war chest cooperative. Through a cost-sharing arrangement a global consortium of trouble-shooters could respond to future spills and blowouts; no single producer or government would have to go it alone. This responsive mechanism should be built into the war chest.

Ixtoc *blasted tons of crude into the Gulf. By now it's probably in the food chain. You may be eating it for dinner.*

The organization should set up a world-wide data bank. In an emergency, a WATS line might bring instant data vital to a given situation. If the great chess matches of the world can be programmed into computers, then the wide variety of variables associated with offshore drilling, pollution control, clean up and inspection also might be programmed into computers.

In our country, Congress is determined to pass a windfall profits bill with a rider placing the blame for disasters with the producer. But blame has limits. Oil pollution involves many innocent people, and the war chest should be willing to supplement clean up and policing on an international scale.

There are probably other ways to achieve the same ends. But right now it's important to face the situation realistically. None of us can afford a continued piecemeal approach. The costs and associated risks of energy research demand some form of mutual reliance.

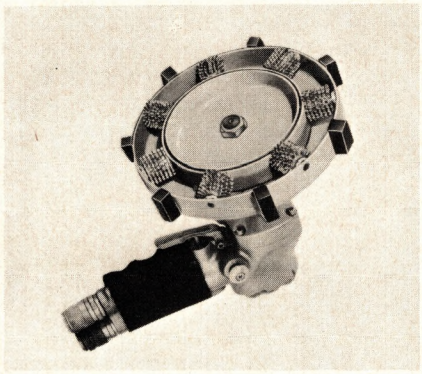
The challenge is as complex—and certainly more immediate—than putting a man on the moon. And it is easily in the same multi-billion dollar cost range. Gamesmanship and going it alone are killing the seas.

President Carter once said our energy crisis was actually a "war" in which every citizen carried a gun. I suspect there's more than a little truth to what he says. But in war, as in energy development, politics and gamesmanship can only prolong the agony.

NEW & IMPROVED

by Kathleen McHugh

Don a cool, cotton T, grab your sturdy canvas tote and shade your baby blues—all in Sport Diver style. Ladies French-cut and men's T-shirts of 50-50 poly-cotton blend come in light blue and tan. Men's sizes S, M, L & XL, $4.95; ladies, S, M & L, $4.95. Ladies 100% cotton lace tank top, available in yellow, S, M & L, $6. Roomy tote bag with logo, $5. Adjustable sunvisor, with terry-cloth lining, is $5. Send check or money order to **Rainbow Graphics, 108 College Ave., Clemson, SC 29631.**



Bust away barnacles and other encrusted sea growth with the Whirl Away Model 637-MA. The tool can remove six inches of growth from steel, concrete and wood pilings, seawalls, bulkheads, ship props, rudders and bridge supports at 3 to 6 sq. ft. per minute. The outside knocker-cutter bars bite into barnacles and the inside steel cutting wheels chip and scrape through barnacle adhesive. Attaches to drive spindle of standard grinders, sanders and polishers. $82.50. Set of 49 replacement cutters, $16.90. Write **Robert C. Collins, Co., 746 N.E. 67 St., Miami, FL 33138.**

Hit the rapids in a blue streak. Blue Line inflatables come in 10, 12 and 14 foot lengths and are designed for optimum balance. Flotation tubes of rugged nylon material with an outside coating of Dupont Hypolan resist punctures and abrasions. Blue rubbing strake protects against impacts and abrasions. Perfect for camping, fishing and river running. Twelve-footer, $799. **Camp-Ways, Inc., 12915 S. Spring St., Los Angeles, CA 90061.**

Fit to dive. BayleySuit's Lycra construction wetsuits allow for better fit with comfort and flexibility. The highly thermal protective Featherlite material suits come in black, blue, red and tangerine. Men's custom farmer john, $366; women's custom farmer john, $396. **BayleySuit, Inc., 900 S. Fortuna Blvd., Fortuna, CA 95540.**

Easy on, easy off. The Sea Otter II combines one hand inflation-deflation with a one strap-buckle jacket design for ease and comfort. Cordura nylon bag is puncture and cut-proof and inner bladder removes for quick repair. Available in two sizes in yellow and blue. $229.95, includes Mariner Kam Bac Pac. **U.S. Divers , 3323 W. Warner Ave., Santa Ana, CA 92702.**

Finding your gear in a crowd is a snap with NAUI's Fish Tags. Ideal for luggage, gear, equipment or even small children, tags are laminated business cards on one side and a special diver message on the other. $2.50 each; certified divers get 10 percent discount. **NAUI Headquarters, PO Box 630, Colton, CA 92324.**

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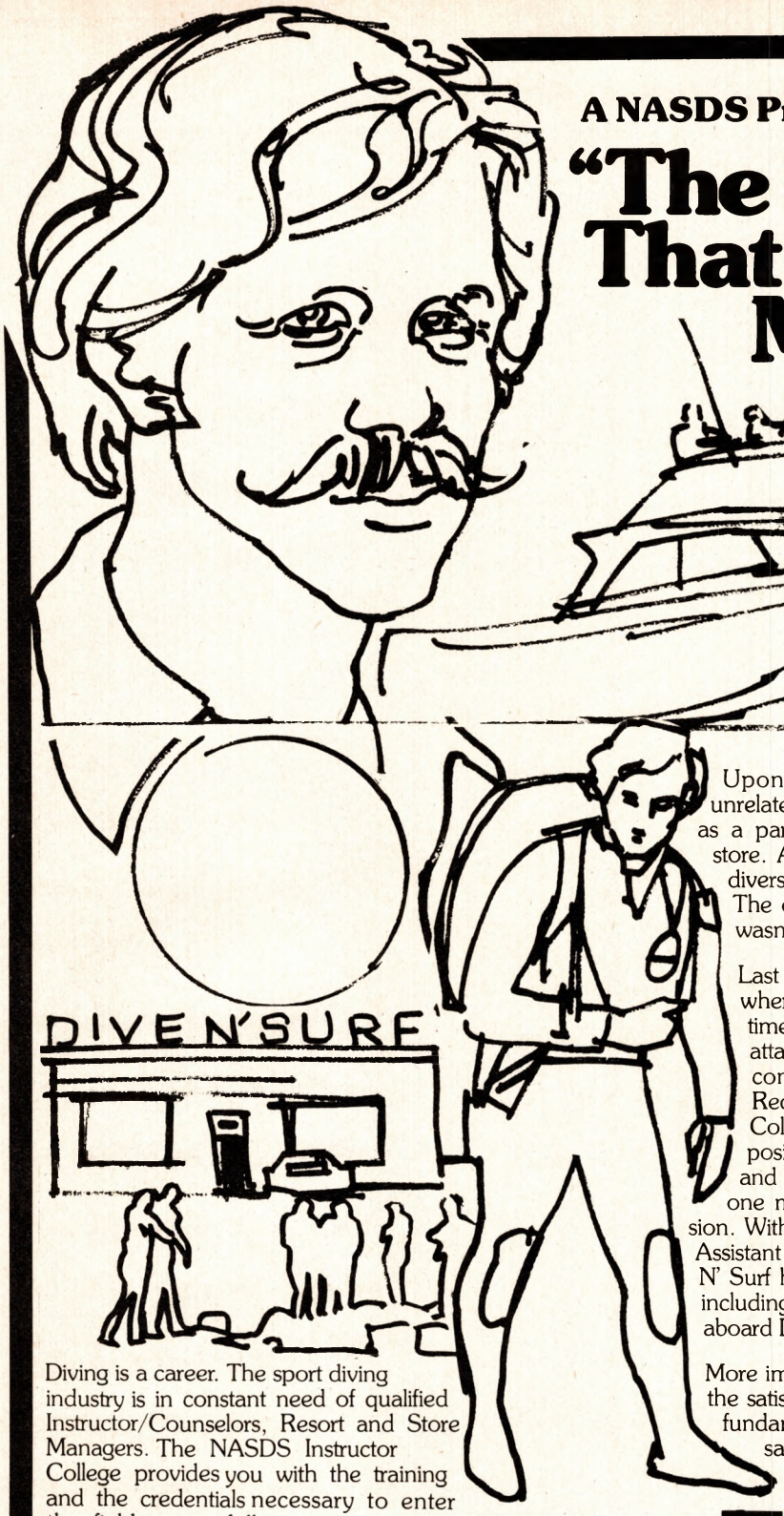

A NASDS Profile: John Burnham

"The Ten Weeks That Changed My Life."

Four years ago John Burnham was thinking about buying his own diving store. At that time he had already been diving for three years, but he knew he needed a better understanding of the diving industry to realize his goal. After looking into all the other scuba diving certification agencies, John decided to attend the 10-week NASDS Instructor College in San Diego, California.

Upon graduation, John went into a business unrelated to diving, but remained active in the sport as a part-time instructor with a non-NASDS diving store. Although he worked hard and certified lots of divers, he was going nowhere in the diving industry. The opportunities seemed to be there, but he just wasn't able to take advantage of them.

Last year John decided to look for a NASDS store where he could resume his career in diving full-time and put into practice the knowledge he had attained at the NASDS Instructor College. He contacted Robbie Meistrel at Dive N' Surf in Redondo Beach, California. As a NASDS OWIC College graduate, he was immediately offered a position as an Instructor/Counselor. He accepted and began work in March of that year. After just one month he knew he had made the right decision. Within five months he had risen to the position of Assistant Manager. After his first 12 months with Dive N' Surf his personal sales totalled over $200,000, not including lesson sign ups and diving vacations and trips aboard Dive N' Surf's boat—the *Westerly*.

More important than John's sales figures, however, is the satisfaction he gets from teaching his students the fundamentals of scuba diving. His students are the safest, best-equipped divers in the world because he teaches the NASDS system.

Diving is a career. The sport diving industry is in constant need of qualified Instructor/Counselors, Resort and Store Managers. The NASDS Instructor College provides you with the training and the credentials necessary to enter the field successfully.

For information on a career in diving, fill in the coupon and mail it today, or call the College at 714-224-3228 and ask for Tony Zimos.

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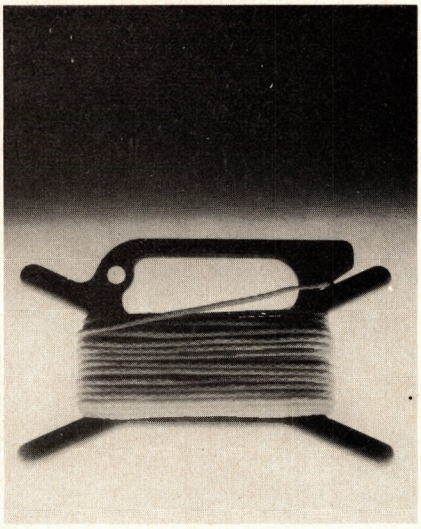
Or call collect Tony Zimos at 714-224-3228.

Skip wide-angle distortion worries. Pop the Subawider II onto a standard Nikonos lens, set the aperture to f-22 and enjoy focus from nine inches to infinity. It works by increasing the lens angle to 90 degrees with minimal distortion. Comes with its own viewfinder, $350. **Farallon/Oceanic, 14275 Catalina St., San Leandro, CA 94577.**



Let there be line. Floating holder with 50 feet of floating line can secure diver's flag, serve as a marker buoy, buddy or safety line or for cave penetration. Comes in orange, blue, green, yellow and opaque. Suggested retail, $8.95. **Gulfview Products, Inc., PO Box 130, Sun City, FL 33586.**

Tell the world you're proud to be a diver. Dacor's license holder of durable ABS plastic will not break, crack, fade or warp. Comes in white with red lettering. $3. **Dacor, 161 Northfield Rd., Northfield, IL.**

Counting bottom time. U.S. Divers' Quartz blends the accuracy of quartz with the durability of stainless steel. Case is guaranteed to 30 atmospheres and the movement has a one-year limited warranty. Crown is offset for comfort and protection and the band compensates automatically for changes in wetsuit thickness. $349.95. **U.S. Divers , 3323 W. Warner Ave., Santa Ana, CA 92702.**

Son of a Gun Snorkel is a scaled-down version of the regular shotgun with the same self-draining features. The 11/16" base diameter and smaller contour mouthpiece fit the tiny bites in your dive group. Suggested retail, $12. **Scubapro, 3105 East Harcourt, Compton, CA 90221.**

Good things come in small wrappers. The SeaJacket II for the mini-diver features an easy reach dump valve, side adjustments, power inflator, CO_2 option, and key ring holder. Comes in yellow with blue trim and two side pockets. With CO_2, $215. **Sea Quest Inc., 722 Genevieve St., Suite N, Solana Beach, CA 92075.**

LEN KAUFMAN

Diving Destination:

CURACAO

BY TIM CAHILL
PHOTOGRAPHY BY
STEVE EARLEY

Explore a chapter of European history in the Amsterdam of the Caribbean.

A few years ago, on a maximally less pleasant assignment than the one that produced this article, I found myself in the midst of a stifling South American jungle, staring full into the face of horror.

A few weeks later I flew out of Guyana, back to the States, but missed my connection and was stranded on an island I was only dimly aware existed: Curacao, and it was a delight in all ways. I stayed a while, and my spirit mended in the sun.

Curacao, I discovered, was one of six islands in the Netherlands Antilles group. The people were ebullient and they spoke Spanish, Dutch, English and a wonderful language called Papiamento which may be the closest thing yet to a universal Western language. Papiamento is a mirror to the history of the Antilles: Curacao was by turns a Portuguese slaving port, a Spanish mercantile port and a Dutch colony. Presently it

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Tim Cahill is a contributing editor for ***Rolling Stone*** *Magazine.*

has one of the largest oil refineries in the world, and many of its products are shipped to the U.S. In return, the U.S. ships down boat- and plane-loads of tourists, as do the countries of South America. Papiamento reflects all of these influences. It is not a pigeon tongue but a true language, and it is maddening because it stands just past the far edge of being instantly understandable. "Masha danki," for instance, means "thank you." "Confusion" is the word for "confusion."

This island just off the northern shoulder of Venezuela cheered me in other ways. It is a virtual desert in the sea. Giant cacti ten to 20 feet tall grow in the countryside. That hot, dry climate, cooled by constant sea breezes seemed the perfect antidote to the damp, suffocating jungles around Jonestown.

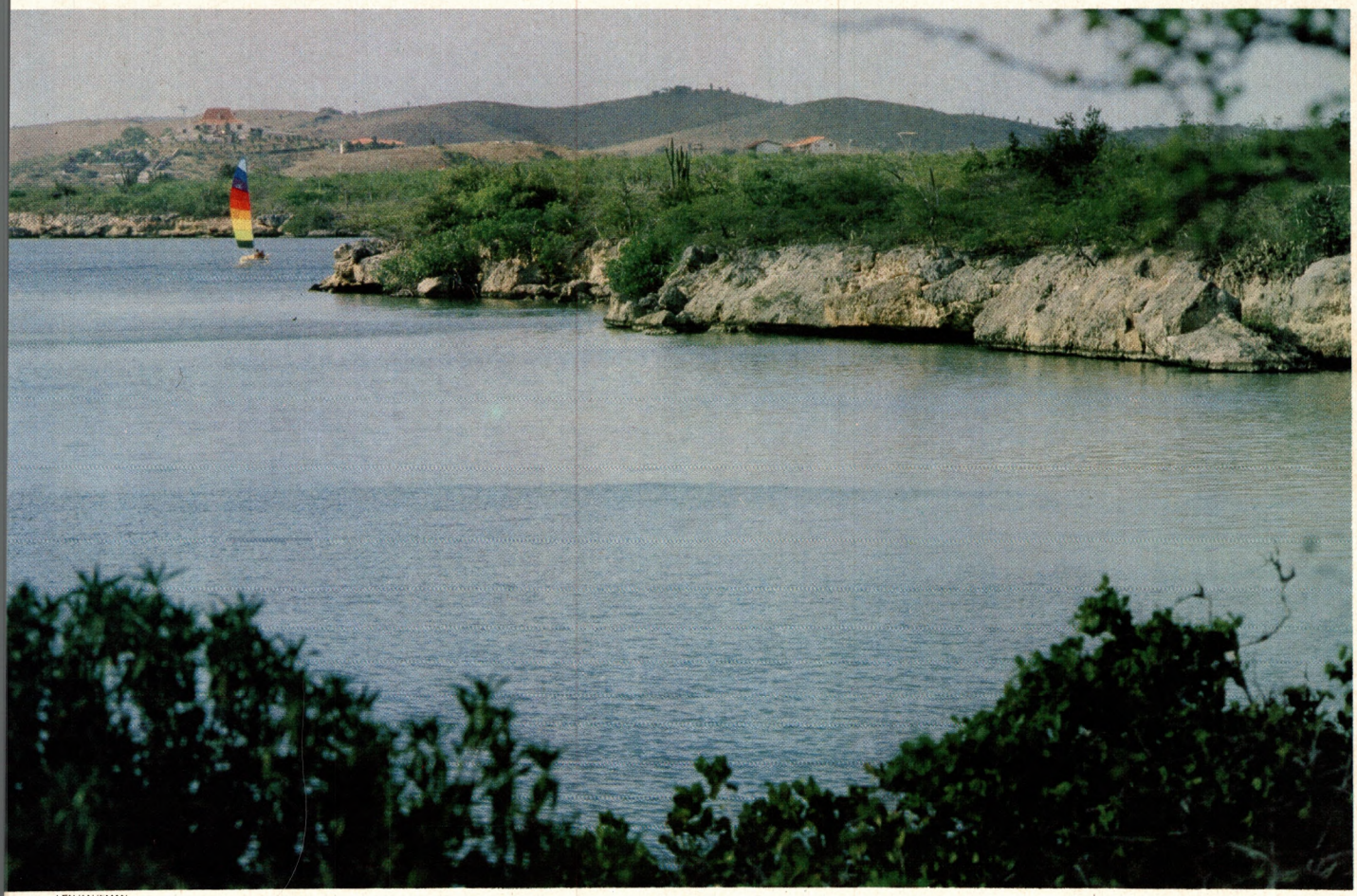
In the mornings I swam in brilliantly clear water just off shore. Twilight was pleasant for a stroll in Willemstad's Punda district: A shopping center with fine restaurants, which, from the Dutch influence, looks like Amsterdam in the Caribbean. At night I discovered I could lose myself — and my money — in any of the big hotel casinos.

Because of these pleasant memories, I felt I owed Curacao something on this second trip. The island is not considered a first-line dream-dive destination. This attitude is part of the price the concerned divers of Curacao have paid to stop collecting and spearing on their reefs. To generate support for conservation measures, they set out to prove the undeniable truth that some of their reefs were dying. Last year, when *Sport Diver* sent a reporter to Curacao, one local guide took him to a totally dead reef; a great crumbly white wall where nothing lived. Nothing.

This time, I decided to arrive on the island unannounced. The things I saw, the service I got would be the same offered any vacationing diver. I didn't think a guide would take a vacationer out to a dead reef for an object lesson.

First I did some snorkeling near my hotel. The reefs were alive, but looked a little washed-out and the fish were

Facing page: Sidewalk cafes and red tile roofs in the Handelskade area of Willemstad, the urban capital of Curacao, are strongly reminiscent of the city's mixed European heritage. Below: Curacao's coastline is punctuated with inviting bays and inlets such as Spanish Waters Lagoon near Willemstad. Overleaf: Lying less than 200 yards off the coast of Curacao in 100 feet of water, this almost intact 150-foot freighter is a popular site for visiting divers.



LEN KAUFMAN

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sparse. West, along the coast highway, away from the heavy boat traffic, the reefs were not only healthy, but actually lush. Fish life was plentiful. I drove to Westpunt, on the rural northwest tip of the island. There the reefs seemed almost untouched, and the fish more than abundant. Westpunt, however, has no scuba operation. It is a 45-minute drive to the nearest compressor.

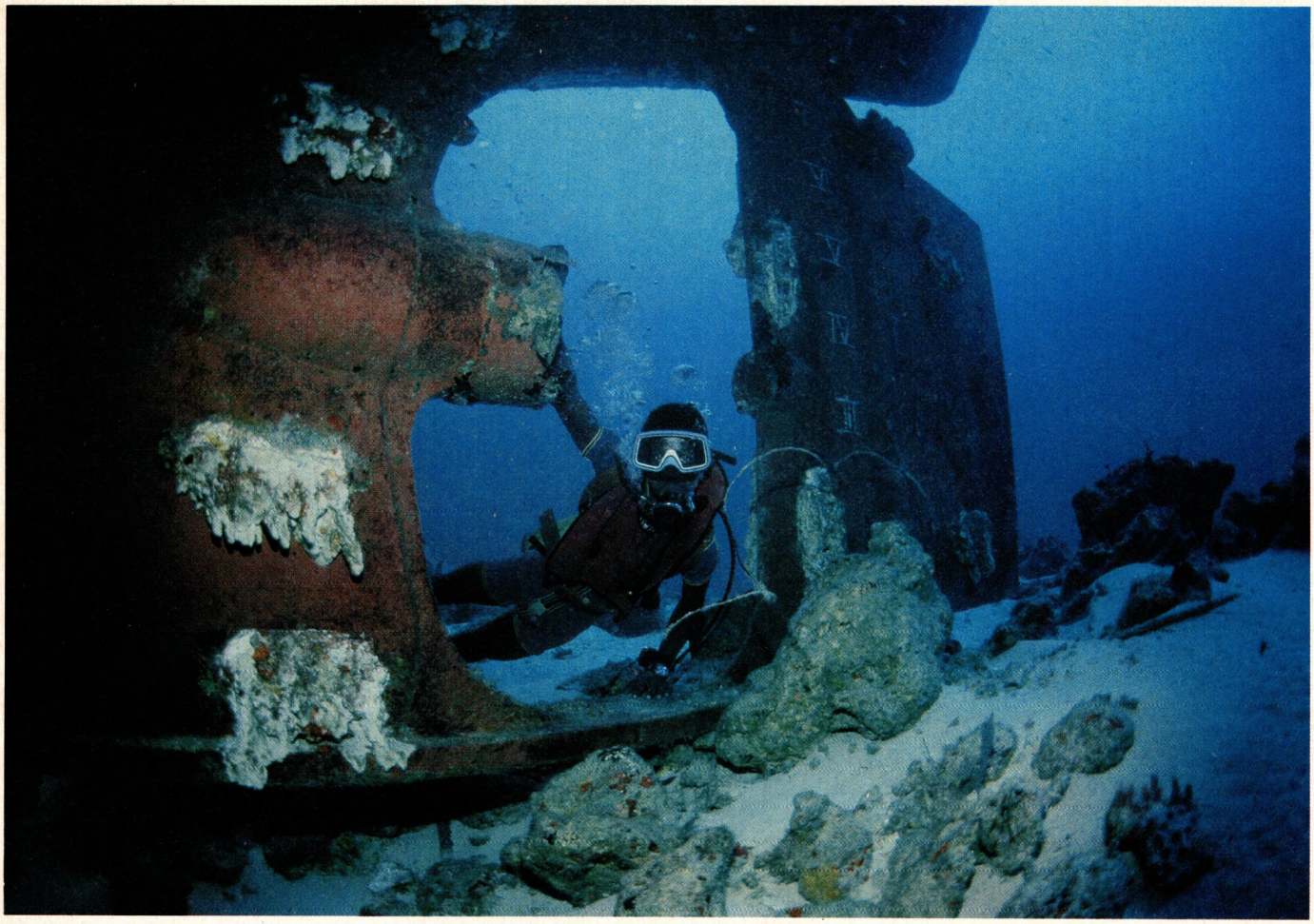
Back at the hotel, I made arrangements for a dive. One operation did not answer its phone, the other told me to show up at 9:30 the next morning. At 9:30, no one but a man loading empty tanks into a truck was around. About ten, a woman arrived who said we'd dive soon. The compressor was broken and the tanks weren't pumped. I waited. The tanks came, but the outboard on the boat wouldn't work.

For all of this aggravation, I have to say that the dive itself was pure pleasure. We went down on a sunken Venezuelan freighter, the *Superior Producer.* It lies in 100 feet of water just 15 minutes from the hotel. The ship was intact, and in surprisingly good shape. The holds were open, as were various rusty cabins.

That night, some folks told me the story of the *Superior Producer.* It had cleared port in good weather, then, suddenly, began to list. It lay on its side for several hours and the crew swam to shore. The ship went down like a stone.

Divers began salvage operations, bringing up soaked consignments of merchandise. To prevent looting, armed guards patrolled at night.

Mending souls is one thing; diving is another. There is some very good diving on Curacao, but not all of the operations have the means or the motivation to reach it. The folks I dove with were in the watersports business, which includes not only diving but sailing and fishing too. There is now one operation—Dive Curacao—exclusively for scuba. But none of the operations has its own compressor. Air is supplied by Master Dive, a retail/rental facility. A full scale resort that serves both the good south side sites and Westpunt could make Curacao a contender with week-long programs. Until then, the smart money says its a place for serious relaxation and some casual dives.



SPORT DIVER DESTINATION DATA

CURACAO

GENERAL
Location: 35 miles north of Venezuela and 42 miles east of Aruba
Size: 180 square miles
Topography: a hilly island with sloping beaches, rocky coastline
Climate: tropical with 22 inches of annual precipitation
Population: 165,000
Largest towns: capital: Willemstad
Languages: Papiamento, Spanish, Dutch, English
Economy: 18% industrial, 82% tourism: major exports: oil, liquor
Monetary unit: N.A. Florin = $.57
Diving season: year-round
Tourist season: Dec.-April

DIVING
Water temperature: 70-80°F year-round
Visibility: 150+ feet
Depth of dives: 0-130 feet
Types of diving: reef, wreck, wall, night
Skill level: novice, intermediate, advanced
Sights:
Fish: angels, squirrelfish, porkfish
Other: wreck of the *Superior Producer*
Restrictions: illegal to detach any coral or transport coral, plants or shells; no spear-fishing allowed

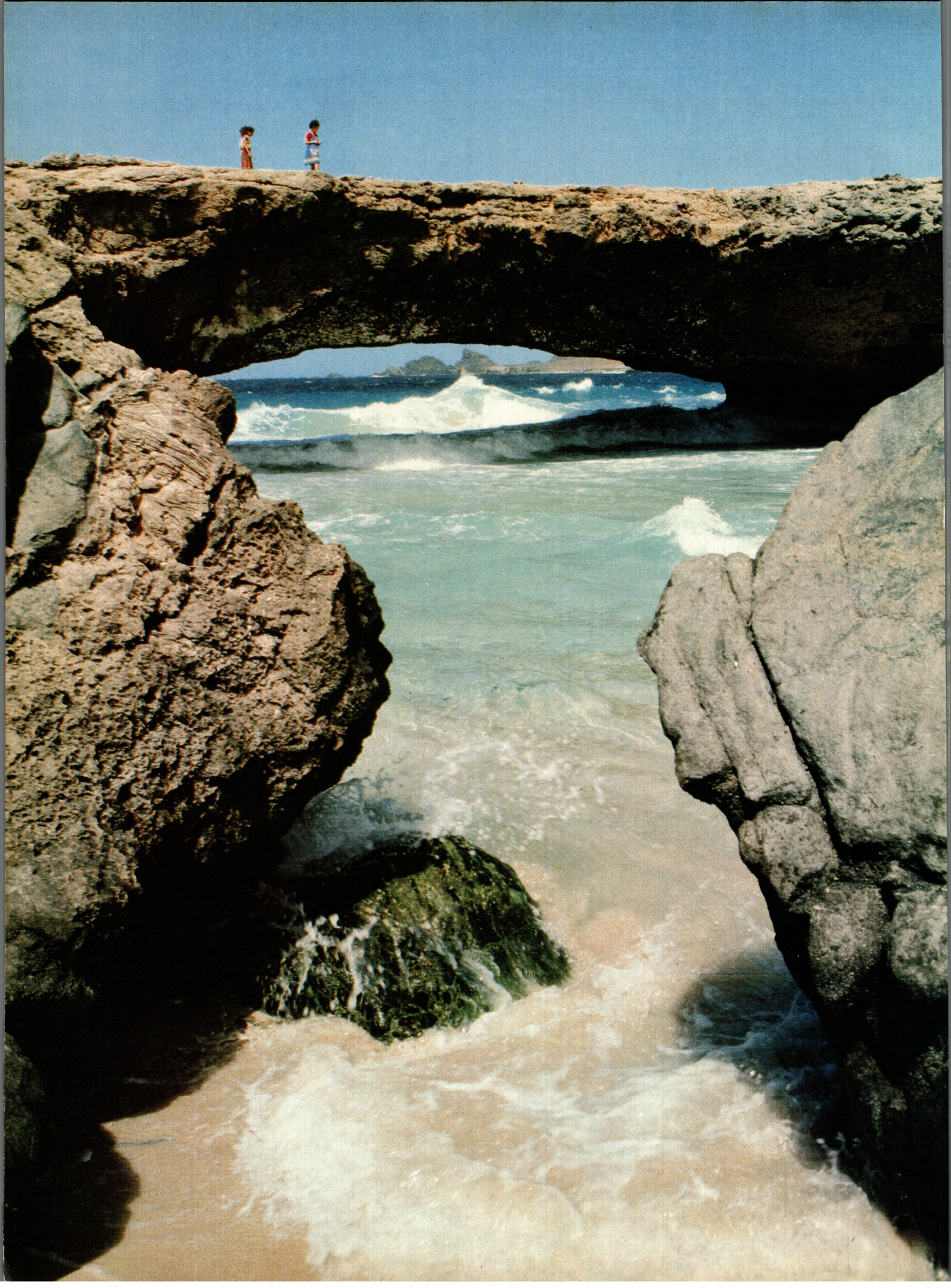
DIVING SERVICES
Instruction available: resort course, open-water certification
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, partial wetsuit
Equipment sales: All the above except: safety vest, BC with inflator, decompression meter, full wetsuit, knife, game bag, dive light, camera housing
Equipment repair: extensive
Camera repair: none
Air: yes
Guides: yes

DIVERSIONS
Ground transporation: bus, taxi, rental car
Shopping: excellent and reasonable
Restaurants: excellent and reasonable, average meal $12
Nightlife: restaurants, theater, casinos, night clubs, discos
Other sports: sailing, skiing, snorkeling, squash, golf, tennis, deep-sea fishing
Don't Miss: Fort Amsterdam, Floating Market, Mikve Synagogue, Curacao Liquor Factory

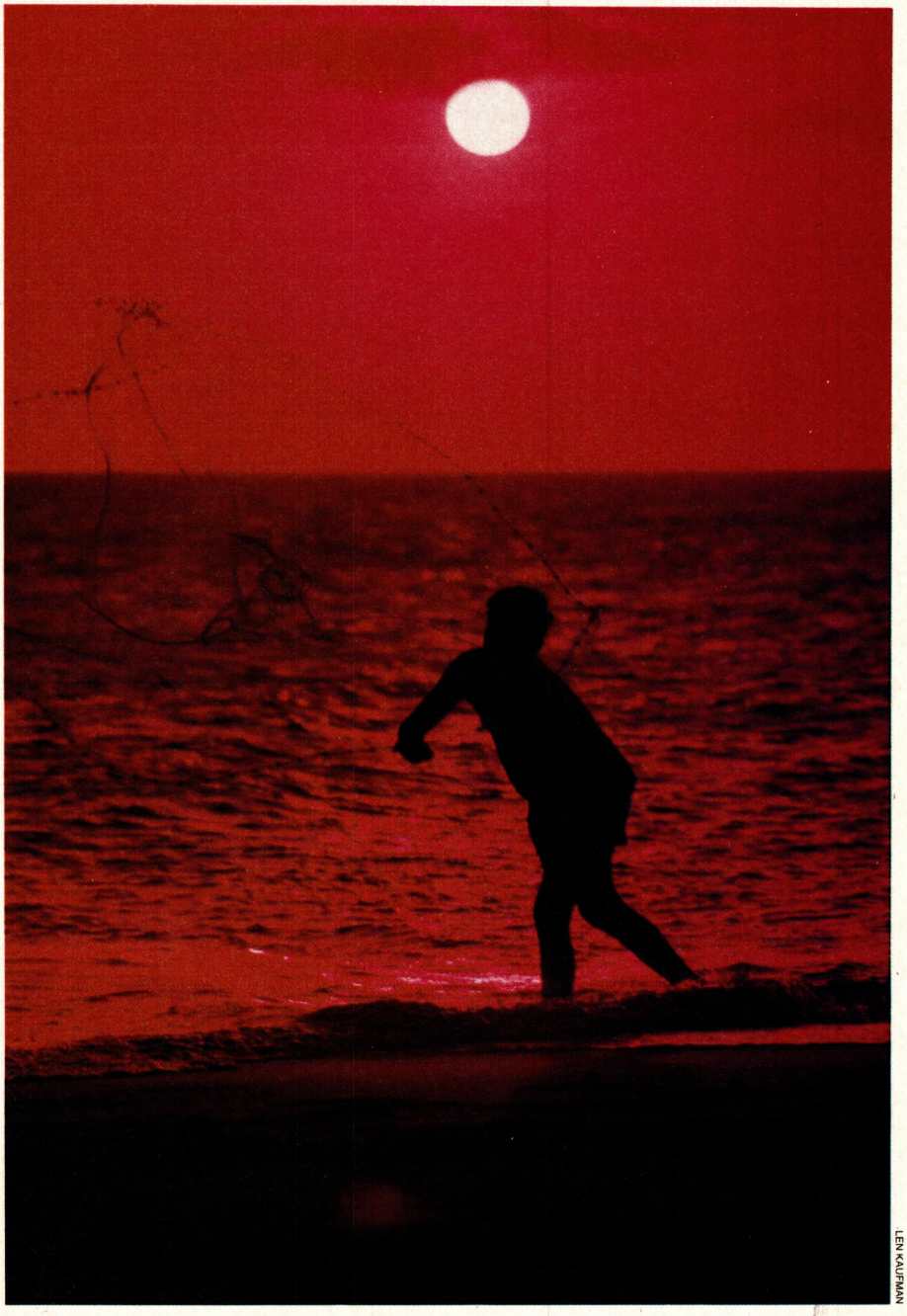
JUST IN CASE...
Hospitals: St. Elizabeth Hospital, Willemstad, ph: 24900
Diving doctors: Dr. Kroon, St. Elizabeth Hospital, Willemstad, ph: 24900
Recompression facilities: St. Elizabeth Hospital, Willemstad, ph: 24900
Police: ph: 4444
Marine Rescue: Channel 16, 156.80 mHz, monitored 24 hours
American Express: Maduro & Sons, Inc., Heerenstraat 21, Willemstad, ph: 599-9-37900
U.S. Consulate: American Consulate, St. Anna Blvd. 19, PO Box 158, Willemstad, ph: 599-9-13066

NETHERLANDS ANTILLES

ON YOUR OWN
Land tours: Taber Tours, Maduro Plaza, ph: 599-9-43845
Airlines: ALM, from Miami, (305) 592-4612; American Airlines, from New York, (800) 433-7300
Pilots info: Dr. Albert Plesman Airport, North Coast, ph: 599-9-82288
Gas: yes
Lighted runway: yes
Repairs: yes
Aeronautical chart: CK-26
Cruise lines: Costa Lines, (800) 327-5704; Norwegian American Lines, (305) 940-0687; Princess Cruises, (213) 553-7000; Royal Caribbean Lines, (800) 327-6700; Sitmar Cruises, (800) 421-0880
Marinas: Curacao Yacht Club, Spanish Water, ph: 599-9-67303; Hilton Marina, ph: 599-9-25000
Nautical chart: 24462
Hotels with dive packages: Curacao Hilton, Box 229, Willemstad, ph: 599-9-25000; Princess Isles Hotel, ph: 599-9-14944
Hotels: Airport Hotel Bianca, ph: 599-9-81120; Arthur Frommer Hotel, Piscadera Bay, Willemstad, ph: (212) 687-8866; Avila Beach Hotel, Box 791, ph: (212) 757-2981; Coral Cliff Hotel, ph: (800) 223-6510; Curacao Plaza Hotel, Box 229, Willemstad, ph: (800) 621-8336; Country Inn, Willemstad, ph: 599-9-36600; Holiday Beach Hotel, ph: 599-9-25400; Hotel Madeira, Willemstad, ph: 599-9-53299; Madeira Inn, Willemstad, ph: 599-9-37500; Hotel Paris, Willemstad, ph: 599-9-24259; Park Hotel, Willemstad, ph: 599-9-23112; San Marco Hotel, Columbusstraat 5-7, Willemstad, ph: 599-9-12988
Campgrounds: none
Customs and Immigration: Requirements: US citizens need proof of citizenship
Import restrictions: no fresh fruits, plants or meats
How much cash may you bring into the country? no limit
Export restrictions: no black coral
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions: $300 worth of goods duty-free



Left: Natural Bridge, a striking stone formation on Aruba's rocky windward shore, is one of the island's most well known landmarks. Rough water predominates on this side of the island – forget your tanks and bring a surfboard. Below: When the shrimp run, cast nets fly on Bonaire's Manchebo Beach.



LEN KAUFMAN

Friendliest of the Antilles, this island may change some ideas about the perfect dive vacation.

ARUBA

There are islands in the Caribbean where some peoples' religious ideals, emphasizing a history of oppression, tend to make white tourists feel distinctly uncomfortable. There are other islands where folks don't much like tourists at all, no matter what color, because the people do not care to become "another nation of busboys and waiters."

Aruba is definitely not one of those. For the tourist, I suspect it is one of the friendliest of all the islands. Perhaps this is because I could never get through a happy hour there without being invited to a party somewhere. Happy hour is an island-wide tradition, and the best bars are located along the northwest coast. They are generally open-air thatched roof affairs that look out to the glassy sea. Drinks are cheap, for two hours anyway, steel bands play and the setting sun burns like fire across the Caribbean; All in all, your perfect vacation fare.

People from New York have known this for years. That's why an island with a population of 60,000 has an airport that will handle jumbo jets.

The main attraction, the thing that brings tourists from New York, and increasingly from the Midwest, is the beach. Neither Curacao nor Bonaire offer anything like it. There are miles and miles of beach, as far as the eye can see: Druif Beach, Manchebo, Eagle and Palm Beach. The bulk of the tourist hotels are located on these beaches. And if one feels there are too many people in a certain spot, it's a short walk to a deserted stretch of sugar-white sand.

In the interior of the island, constant winds have molded the divi divi trees into fantastic and bizarre shapes. Giant cacti grow in such profusion that farmers use them to make fences.

Offshore, Aruba offers some good diving. The only operation on the island is Sub Sea Safaris. Anton Segers opened Sub Sea in 1976. Curacao-born and Dutch educated, Anton ("Tone"), with his ferocious red beard and trim build, looks every bit the commercial diver he used to be. When he opened up, the residents thought he was just a bit loony. Aruba was not a diving destination, and a number of failed scuba entrepreneurs on the island could attest to the fact.

The first year, Segers counted about

continued

2000 customers — mostly snorkelers and people who only wanted to take a dive or two during their stay. Last year, Segers said, he tallied some 8000 customers. Clearly, the word is getting out.

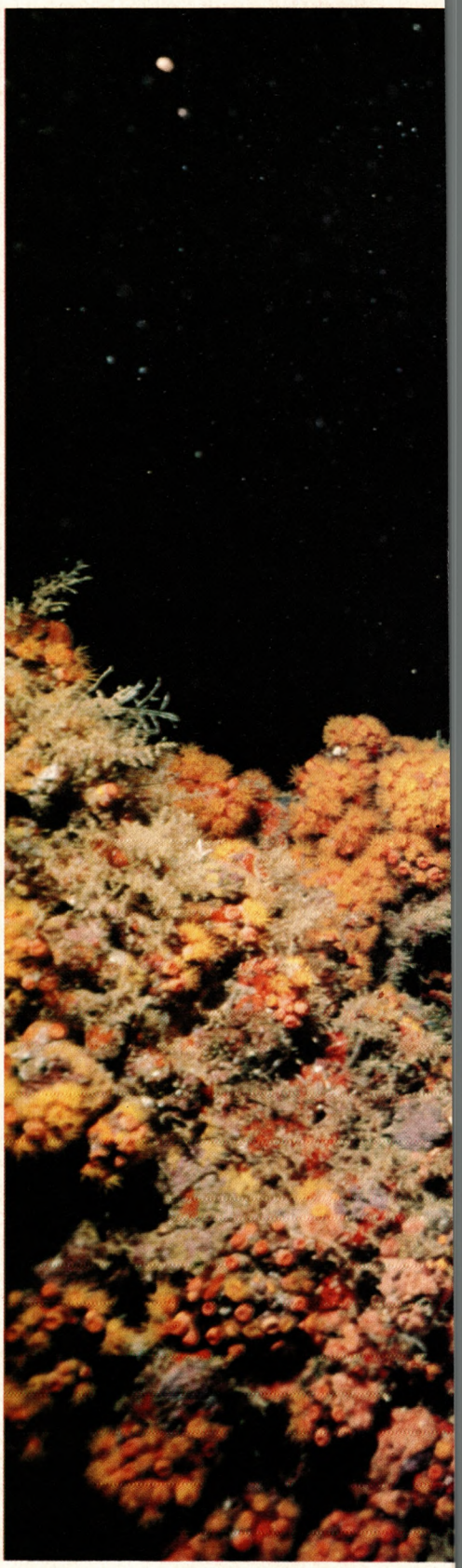
Sub Sea regularly sends its boat to ten sites on the leeward side of the island. Some sites are large enough to require several dives to cover them. If the weather should be bad along the northern half of the island, it is likely to be better down south, and vice versa. While some sites may be blown out for a day or two, others are likely to be available in the meantime.

The northeast side of Aruba, the windward side, is generally choppy and the currents can be treacherous.

I dove a site just out of Oranjestad called Harbor Reef. The fish were abundant: angelfish and other tropicals along with puffers, grunts, coronet fish and squirrel fish. One spiny lobster lurking in a brain coral cave had to be the grandfather of all lobster. The beast was the size of a portable TV. Below the staghorn were masses of healthy brain coral, green and purple star corals, plume worms and many colorful sponges. Unfortunately, a swell was kicking sand up off the bottom, and it reduced visibility to about 40 feet.

Along the south shore of Aruba are some deep reefs, 75 to 90 feet, and the corals there are said to be lush. "The deep reefs should be reserved for more experienced divers," Segers told me, "If we get four or five serious divers, we'll take them there."

These may be the best reef dives off Aruba. The wonderful beach that drew the tourists to Aruba also kicks up a lot of sand, even in the mildest weather, and tends to make the water in the northwest a bit turbid. This may be all for the best in the case of one of the island's stellar attractions, the wreck of the *Antilla*. This German freighter lies in about 55 feet of water, and its mast is just visible from shore. When World War II broke out, the *Antilla* was docked in Aruba, a Dutch port. With no guns to protect his ship, the German captain scuttled the *Antilla* so it would be of no use to the Allies. The captain and crew were placed in a POW camp on the site of what is now the Flamingo Beach Hotel on Bonaire. This is not such a bad place to spend four



Above: A pair of blackbar soldierfish, Myripristis jacobus, *patrol Harbor Reef just off Oranjestad. Right: The German freighter* Antilla, *scuttled during World War II, offers something for everyone. Snorkelers can investigate shallow parts of the wreck in less than 20 feet of water, and the more adventurous can explore its coral-encrusted cargo hold at 50 to 70 feet.*

continued

Shallow walls and dropoffs near Aruba's western shore show a rich diversity of marine life, in contrast to the more turbulent northeastern side of the island.

years, and it had to be a hell of a lot warmer (and safer) than the Russian front.

But the *Antilla* is in the northwest, so swells tend to bring up a lot of fine sand from the bottom. This makes the dive somewhat dark, and the darkness adds to the effect. Wrecks should be mysterious. Just before descent, I felt a clammy churning: there is something big, something huge down there, and this realization opened my mind to primitive fears.

"The *Antilla*," Segers told me over gin and tonics during happy hour one night, "is one of the most intact 40-year-old wrecks you'll ever see. We used to have regularly scheduled night dives to it, but too many customers got caught up in happy hour and then wandered off to the casino or to a party. This is a big island for parties. That's why we schedule our morning dive for 11 a.m. The water is a little more clear about eight, but we just couldn't get people up that early. Still, if we get four or five divers who will absolutely agree to appear at 7:30, we'll take them out."

For the record, I did team up with four divers and Segers got us off at eight sharp. His operation may be friendly and low key, but it is properly efficient.

"Lately," Segers said, "we've been trying to bring more serious divers down. We're trying to set up a package with Dive Bonaire to dive four days there, then bring them to Aruba for two days, show them what we have to offer and let them party it up a bit. There isn't much night life on Bonaire, and this way a diver can balance out his vacation."

Happy hour was over and the bar was beginning to empty. Segers said we could have dinner, then maybe go to a party he knew about. Or we could skip dinner and get right down to some serious partying.

We were on Aruba and the party sounded like a real winner.

continued

SPORT DIVER DESTINATION DATA

ARUBA

GENERAL
Location: 15 miles north of Venezuela and 42 miles west of Curacao
Size: 70 square miles
Topography: a flat, hilly island with sloping beaches, rocky coastline, seaside cliffs
Climate: tropical with 20 inches of annual precipitation
Population: 64,000
Largest towns: capital: Oranjestad (pop.) 20,000, San Nicholas
Languages: Papiamento, Dutch, English, Spanish
Ethnic composition: Indian/white 80%; black 20%
Economy: 30% industrial, 70% tourism
Monetary unit: N.A. Florin = $.57
Diving season: year-round
Tourist season: Dec-April

DIVING
Water temperature: 78-79°F year-round
Visibility: 50-60 feet
Depth of dives: 10-100 feet
Types of diving: reef, wreck, night
Skill level: novice, intermediate, advanced
Sights:
- Fish: grouper, angel, grunts, snapper, puffer, coronetfish
- Coral: elkhorn, brain, star, plume worms
- Sponges: more than ten varieties
- Other: spiny lobster, wreck of the *Antilla* & *Pedernales*

Restrictions: no live coral may be taken

DIVING SERVICES
Instruction available: resort course, open-water certification
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, BC with inflator, depth gauge, partial wetsuit, dive light
Equipment sales: All the above except: weight belt, weight, tank, backpack, pressure gauge, depth gauge, compass, decompression meter, full wetsuit, partial wetsuit, Nikonos, camera housing, underwater strobe
Equipment repair: extensive
Camera repair: limited
Air: yes
Guides: yes

DIVERSIONS
Ground transportation: bus, taxi, rental car, motorbike, bicycle
Shopping: good and reasonable
Restaurants: excellent and reasonable
Nightlife: restaurants, casinos, discos, steel bands, happy hour
Other sports: tennis, sailing, waterskiing, deep-sea fishing, horseback riding, bowling, paddleboats
Don't Miss: natural bridge rock formation of Oyo, gold mill ruins at Balashi and Bushribana, Divi Divi trees, wild parakeets at Frenchmen's Pass

NETHERLANDS ANTILLES

JUST IN CASE...
Hospitals: Horacio Oduber Hospital, L.G. Smith Blvd., Oranjestad, ph: 4300
Diving doctors: ph: 599-9-24900
Recompression facilities: St. Elizabeth Hospital, Willemstad, Curacao, ph: 599-9-24900
Police: ph: 4555 or 4000
Marine Rescue: UHF 156.80 mHz Channel 16; UHF 156.55 Channel 11
American Express: Madura & Sons, Inc. 106 L.G. Smith Blvd., Oranjestad, ph: 3888
U.S. Consulate: American Consulate, St. Anna Blvd. 19, PO Box 158, Willemstad, Curacao, ph: 599-9-13066

ON YOUR OWN
Land tours: De Palm, Box 656, L.G. Smith Blvd., Oranjestad, ph: 599-8-24400
Airlines: ALM, from Miami, (305) 592-4612; American Airlines, from New York, (800) 433-7300
Pilots info: Princess Beatrix Airport, Oranjestad
Gas: yes
Lighted runway: yes
Repairs: no
Aeronautical chart: CK-26
Cruise lines: Costa Lines, (800) 327-5704; Holland America Lines, (800) 223-0660; Norwegian America Lines, (213) 422-3905; Princess Lines, (213) 553-7000; Royal Caribbean Lines, (800) 327-6700; Sitmar LInes, (800) 421-0880
Marinas: Aruba Nautical Club; Bucuti Yacht Club
Nautical chart: 24463
Hotels with dive packages: Americana Aruba Hotel & Casino, L.G. Smith Blvd., Palm Beach, ph: (800) 228-3278; Holiday Inn Aruba, Palm Beach, ph: (800) 238-5510; Talk-of-the-Town, L.G. Smith Blvd., Oranjestad, ph: 3380

Hotels: Aruba Beach Club, Box 368, L.G. Smith Blvd., Oranjestad, ph: 4595; Aruba Caribbean Hotel & Casino, Palm Beach, ph: 2250; Aruba Concorde Hotel & Casino, L.G. Smith Blvd. 77, Palm Beach, ph: 4474; Aruba Sheraton Hotel & Casino, Palm Beach, ph: 3900; Basi Ruti Beach Hotel, Palm Beach; ph: 2222; Divi Divi Beach Hotel, Druif Beach, Oranjestad, ph: 3300; The Edge's, 458 L.G. Smith Blvd., Oranjestad, ph: 1072; Manchebo Beach Resort Hotel, Manchebo Beach, ph: 3444; Tamarijin Beach Hotel, Druif Beach, ph: 4150

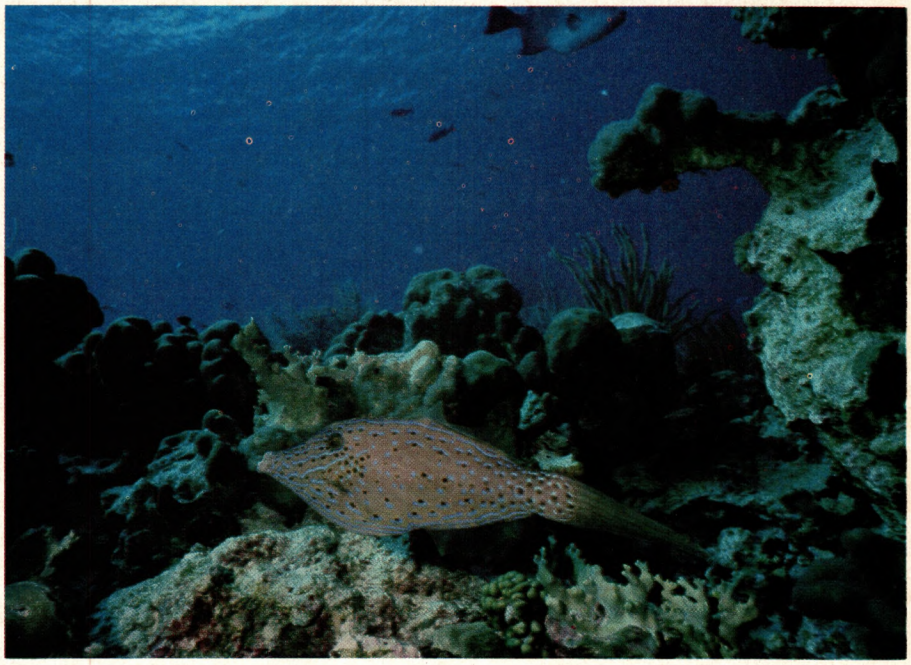
Campgrounds: none
Customs and Immigration: Requirements: proof of citizenship
Import restrictions: none
How much cash may you bring into the country? no limit
Export restrictions: none
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions: $300 worth of goods duty-free

Coats and ties are "strictly forbidden" here.
This is the divers' island.
The reasons are obvious–and spectacular.

Below: Sporting more dive sites than divers, Bonaire's coastline offers infinite easy entries and secluded beaches. Below right: A scrawled filefish, Alutera scripta, *cruises a coral ravine off Karpata Beach.*

LEN KAUFMAN

BONAIRE



From the air, Bonaire looks much like any other desert island, except for the aquamarine outline. The island is surrounded by the cobalt blue of deep water, but it looks as if a child has taken an aquamarine crayon and drawn a thin outline around the land. On the ground, one can plainly see that the aquamarine outlines are an area of crystalline shallow water extending perhaps 30 yards. Where the shallow water ends the walls and reefs start, and they can take you deeper than you'll ever want to dive.

About half a mile offshore there is another island, Klein Bonaire, surrounded by the same shallow-water outline. The diving off Bonaire and Klein Bonaire is simply spectacular. It is also the most convenient diving I have ever encountered. One simply rolls out of bed, walks down to a shop where the gear is stored, gets on a boat, and in five to 15 minutes, you're diving Bonaire.

At Carl's Hill, there are many soft sponges and corals. In one spot, there are two promontories jutting off the wall proper, and crossing between them with the twilight of the abyssmal deep below, I felt the very real sensation of flying.

Off the beach at Karpata there are deep ravines running down to 120 feet; the sheeting corals on either side were green with streaks of iridescent purple. At the Forest, on the east end of Klein Bonaire, there were sea fans, some ten feet across and ten feet tall. And they were perfect. None of the rips and tears you see in a high-energy zone or a high dive-traffic area. Everywhere great golden sea whips swayed in the gentle surge. They were soft to the touch, almost furry, a material you'd make an underwater teddy bear out of. Trumpet-

continued

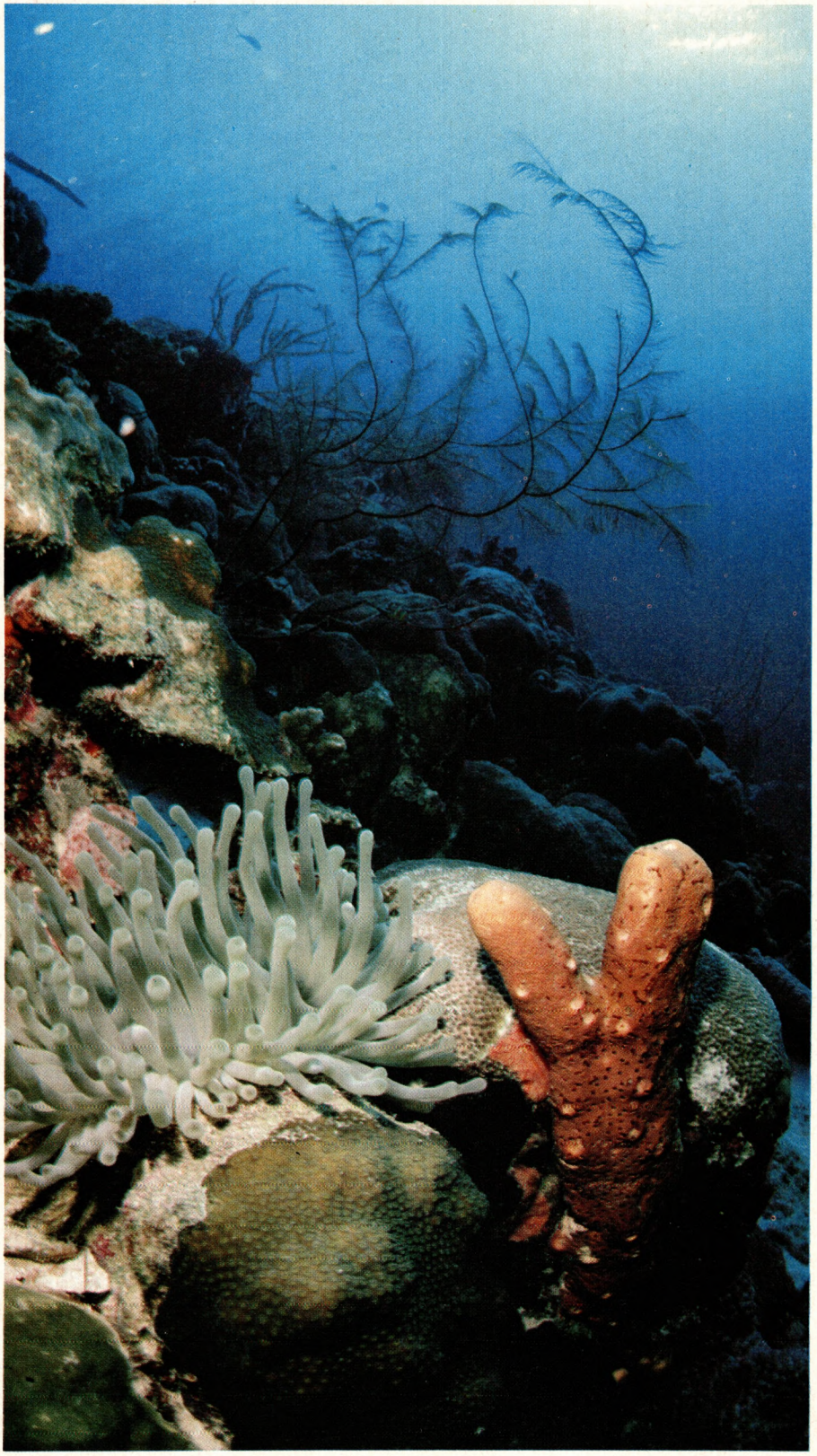
fish hung head-down in the golden whips, and clouds of triggerfish and tangs went about their business in the crystal water. There were four varieties of angels as well as butterfly fish, jackknifes, squirrels, and rock hinds.

Hard corals are ridiculously, almost embarrassingly abundant: staghorn, three different brain corals, leaf coral, scroll coral, elkhorn and brilliant plate corals. Some of these are found in only ten feet of water, so their colors are incredibly bright. In the forest, I came upon a little alcove in the wall. There I saw a flattish barrel sponge, like a small green easy chair for a hobbit. A twisting purple tube sponge with several branches grew next to the seat, like a shade tree, and in back of the chair was a small white sea fan set against red and green sheet coral, like a picture on the wall. White and rose plume worms peeked out of tiny holes in the corals and brilliant tropicals swam everywhere.

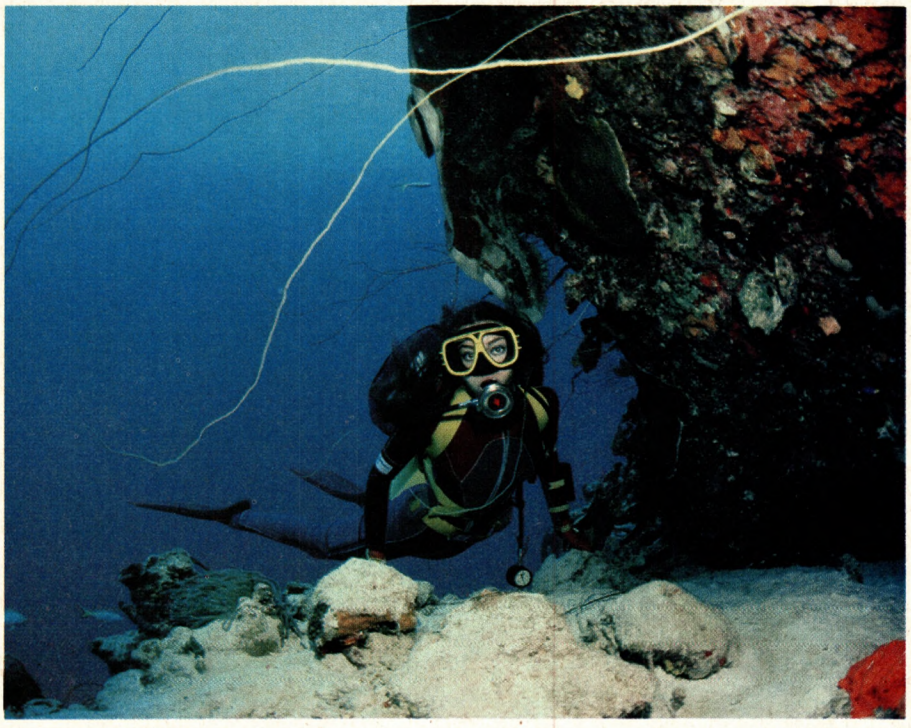
All this I found in one alcove about six feet by six feet. And the entire wall, as far as I swam in both directions, as deep or as shallow as I went, was like that. It was both absurd and wonderful. I was simply giddy with awe.

There is no doubt that Bonaire offers some of the very best diving in the Caribbean. It also has modern, efficient diving operations. The newest of these is Bruce Bowker's Carib Inn. This beach-front pension has only four rooms, but has a compressor and full range of rental equipment. The Carib Inn might be used best by divers who already know Bonaire and will want to rent a car to do the dozens of beach dives around the island.

For larger parties or those who prefer boat diving, there's still another choice. Peter Hughes' Dive Bonaire, in the Flamingo Beach Hotel, is one of the largest, best-equipped scuba operations in the Caribbean. And Peter runs it with crackling efficiency. Want easy access to the reefs, in boats that go out on time and are handled by pleasant and competent boatmen? Peter's got it down to a science. Captain Don Stewart offers similar services from two locations. Most days you'll find him at the Habitat,



Left: Feathery crinoids and anemones dominate the quiet waters of The Forest, a shallow reef off the east side of Klein Bonaire. Below: Patty Schaefer explores the "Small Wall," a colorful reef in 40 to 50 feet of water near Bonaire. Bottom: At Carl's Hill, a popular site just off Klein Bonaire, a parrotfish munches coral and algae. The algae is food – the coral is ground into sand by the fish's powerful teeth.



a complex of beachfront cabins just out of the capital, Kralendijk. Habitat boasts the cheapest rooms on the island — tiny monk's cells with a bed, toilet and hardly enough room to swing a cat in.

The Habitat reflects Captain Don's personality. He's 54, tan, fit as a man half his age, and there's a gold ring in his ear. He looks more than a little like Errol Flynn in his pirate days. The rooms he rents are clean but in no way luxurious. The Captain says he caters to serious divers who would rather spend their money diving than sleeping.

If you want your diving livened up with personality, the Habitat might be your place. Some people, however, don't like the Captain. They find him arrogant, macho, bumptious. Those people can spend a little more, stay in a deluxe room at the Hotel Bonaire and dive on the twice-daily trips Stewart runs.

Peter Hughes runs similar trips from the Flamingo Beach Hotel at least three times daily, not counting extra beach dives. The Flamingo Beach is the antithesis of the Habitat. It underwent a complete facelift last winter and now has a large freshwater pool, air conditioned rooms, a Jacuzzi and a four-floor dining room that projects over the ocean where — the literature says — coats and ties are "strictly forbidden."

Hughes and Stewart are strange competitors. They have nothing but praise for each other. And, as the biggest operators on the island, they share the credit for the healthy condition of the reefs. No spearing or collecting is allowed. In Bonaire, you can legitimately feel as if you're looking at the reefs the way they were thousands of years ago. I saw black coral at 30 feet.

Aside from the reefs, the weather conspires to make Bonaire a paradise. Like Aruba and Curacao, the island is too far south to catch hurricanes during the season or to suffer the northwest storms that bedevil the northern Caribbean. "In four years on Bonaire," says Peter Hughes, "I've never had to cancel a dive." Anyone who's been blown out of the water for three days on a ten-day vacation can appreciate that.

Another nice thing about Bonaire is

continued

the lack of regimentation. There are no serious currents to worry about, and though there are no decompression dives and the buddy system is strictly enforced, once you've shown your C-card and done a warm-up dive, you can go just about anywhere. Divers often choose their own destinations, and there is none of this following the guide with ten people in tow and coming up with 1500 pounds in your tank because one person is low on air. Hughes and Stewart liken their operations to car rental agencies: Once you've shown your license, no one is going to sit in the passenger seat and tell you how to drive.

In Bonaire, you have to work hard to make diving an unpleasant experience.

Coral polyps strain seawater for plankton on a shallow coral reef near Kralendijk Harbor.

At Your Service

The following dive operations provide tours and equipment rental for dive sites in the Netherlands Antilles.

Aruba

Sub-sea Safaris (Anton Segers) Argentiniestraat 15, Oranjestad, Aruba, N.A. Phone: 23900, ext. 917.

Bonaire

Aquaventure Habitat (Capt. Don Stewart) P.O. Box 34, Kralendijk, Bonaire, N.A. Phone: 8290.

Carib Inn (Bruce Bowker) P.O. Box 68, Bonaire, N.A. Phone: 8819.

Dive Bonaire (Peter and Alice Hughes) J.A. Abraham Blvd., Kralendijk, Bonaire, N.A. Phone: 8285.

Hotel Bonaire (Jack Kirks) P.O. Box 34, Kralendijk, Bonaire, N.A. Phone: (800) 223-2242.

Curacao

Master Dive, Inc. (Frank Englehardt) Fokkerweg 13, Curacao, N.A. Phone: 54312.

Piscadera Watersports (Ben Van Dalen) Curacao Hilton, Willemstad, Curacao, N.A. Phone: 2500.

Scubaneers Underwater Tours (Bert Knubben) Princess Isles Hotel, Willemstad, Curacao, N.A. Phone: 14944.

Dive/Hotel Packages **Live Aboard Boat Charters** **Night Dives** **Retail Sales** **Gear Repairs** **Day Boat Trips**
Snorkel Trips **Boat Charters** **Full Certification** **Tank Rentals** **Gear Rentals** **Resort Course** **Air Station**

SPORT DIVER DESTINATION DATA

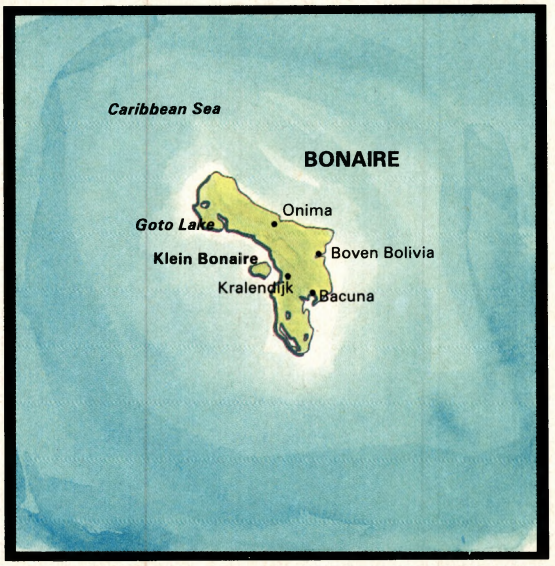
BONAIRE

GENERAL
Location: 50 miles north of Venezuela and 30 miles east of Curacao
Size: 112 square miles
Topography: a flat, hilly desert island
Climate: tropical with 22 inches of annual precipitation
Population: 9075
Largest towns: capital: Kralendijk (pop.) 2500
Languages: Papiamento, Dutch, English, Spanish
Economy: 70% industrial, 30% tourism; major exports: oil, salt, textiles
Monetary unit: N.A. Florin = $.57
Diving season: year-round
Tourist season: Dec.-April

DIVING
Water temperature: 80° F year-round
Visibility: 100-110 feet
Depth of dives: 50-130 feet
Types of diving: reef, wreck, wall, night, cave, beach
Skill level: novice, intermediate, advanced
Sights:
Fish: trumpetfish, butterfly fish, queen angels, fairy basslet, rock hinds, blue chromi
Coral: coral bowl, green, black, elkhorn, gorgonia, staghorn, star, brain, pillar, sea fans & whips
Sponges: blue vase, tube, basket, orange, vase
Shells: cowrie, flamingo tongue, volute
Invertebrates: eel, rays
Other: lobster
Restrictions: no spearfishing; illegal to remove any black coral or other marine life

DIVING SERVICES
Instruction available: resort course, open-water certification
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, safety vest, BC, pressure gauge, depth gauge, partial wetsuit, dive light, Nikonos, underwater strobe
Equipment sales: All the above except: decompression meter, full wetsuit, Nikonos, camera housing, underwater strobe
Equipment repair: limited
Camera repair: limited
Air: yes
Guides: yes

DIVERSIONS
Ground transportation: bus, taxi, rental car, bicycle
Shopping: fair and reasonable
Restaurants: good and reasonable, average meal $9-11
Nightlife: lounges, casinos, discos, restaurants
Other sports: tennis, waterskiing, sailing, fishing, bodysurfing
Don't Miss: Karpata, Angel City, Washington National Park, Flamingo Sanctuary



NETHERLANDS ANTILLES

JUST IN CASE...
Hospitals: St. Francis Hospital, Kralendijk, ph: 599-7-8900 or 8445
Diving doctors: Dr. Henk Welvaart, ph: 599-7-8316
Recompression facilities: St. Elizabeth Hospital, Curacao, ph: 599-9-24900
Police: ph: 8000
Marine Rescue: ph: 8151; UHF 16
American Express: no local representative
U.S. Consulate: American Consulate, St. Anna Blvd. 19, PO Box 158, Willemstad, Curacao, ph: 599-9-13066

ON YOUR OWN
Land tours: Bonaire Trading Company, Kralendijk, ph: 599-7-8300, ext. 25
Airlines: ALM, from Miami, (305) 592-4612; American Airlines, from New York, (800) 433-7300
Pilots info: Flamingo Airport, Bonaire, ph: 599-7-8600
Gas: yes
Lighted runway: yes
Repairs: yes
Aeronautical chart: CK-26
Cruise Lines: Holland America Lines, (800) 223-0660; Home Lines, (212) 432-1414; Norwegian America Lines, (305) 940-0687; P&O Lines, (214) 750-1040; Royal Viking Lines, (800) 227-4246
Marinas: Bonaire Yacht Club, Hotel Bonaire, Kralendijk, ph: 599-7-8448
Nautical chart: 24461
Hotels with packages: Bonaire Beach Bungalows, Box 155, ph: 599-7-8585; Captain Don Habitat, Kralendijk, ph: 599-7-8290; Carib Inn, PO Box 68, ph: 599-7-8819; Flamingo Beach Hotel, Box 143, Kralendijk, ph: 599-7-8285; Hotel Bonaire, Box 34, Kralendijk, ph: 599-7-8448
Hotels: Hotel Rochaline, Box 27, Kralendijk, ph: 599-7-8286
Campgrounds: none
Customs and Immigration: Requirements: Proof of citizenship & return ticket
Import restrictions: no animals
How much cash may you bring into the country? no limit
Export restrictions: no black coral or tropical fish
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions: $300 worth of goods duty-free

SUBSEA SAFARIS/DE PALM TOURS— ORANJESTAD, ARUBA ISLAND

Argentiniestraat 15, Oranjestad, Aruba, N.A. Phone: 23900, ext. 917.

RESERVATIONS: SUBSEA SAFARIS, c/o De Palm Tours, L.G. Smith Blvd., Box 656, Oranjestad, Aruba, N.A. Phone overseas operator: 24400 or 24545. Telex 5049-D Palm NA.

LOCATION—Dive shop is located on beach between Sheraton and Caribbean Hotels on west side of island. 15 minutes from town and airport. De Palm Tours offices in 10 hotels.

TRANSPORTATION—Air: ALM from Miami, American, Air Canada from New York. Ground: courtesy car pickup, taxi from airport $4, car rentals available in town and at hotels.

ACCOMMODATIONS—De Palm Tours can arrange reservations at 10 hotels all within 2 mile radius of SubSea Safaris. Hotels range from first class to luxury, many with restaurants, bars, lounges with live entertainment and casinos. Complete watersports include waterskiing, fishing, pedal boats, glassbottom boat, sailing, snorkeling and boat rentals. Rates: prices range from reasonable to expensive. Most hotels accept major credit cards.

DIVING AVAILABLE—

Shallow reef **yes**	Walls **yes**	Drift dives **no**
Mid reef **yes**	Wrecks **yes**	Night dives **yes**
Deep reef **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—Rix compressor, 5000 PSI, 80 tanks 72 cu/ft. 2 dive boats, both 36' Pilotboat with 40 total diver capacity. Full service retail store, minor gear repair. Film in stock with 48 hr. processing. U/W camera rentals and sales.

DIVING SERVICES—PADI, NAUI affiliation. 6 instructor/divemasters CPR first aid trained. Resort course $35. Full certification available as well as U/W photography course. Cost half day diving (1 tank) $25, full day (2 tanks) $35, night dive $25. Rate includes all gear, discount if own gear provided.

DIVING PACKAGES—De Palm Tours can arrange special packages and group rates at any of 10 hotels. Includes accommodations, meals, gear, diving, transfers. For complete details, package prices and other information contact above address.

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ARUBA IS A DIVING DESTINATION

DE PALM TOURS

Sub-sea Safaris

Besides being one of the most continental islands in the Caribbean — Aruba has excellent diving. For complete information on reservations, watersports, sightseeing tours, casinos and everything you need to know about Aruba, contact De Palm tours© or your local travel agent.

BONAIRE in brief

GENERAL—Bonaire is the place to go for watersports and get-away vacations. Superb underwater visibility and beautiful reef formations make it an ideal place for snorkeling, scuba diving, and skin diving. Calm protected waters make sailing, boating and fishing a pleasure. Ernest Hemingway wrote about the legendary Green Flash of the Caribbean and nowhere are the conditions more favorable than in Bonaire to see this spectacular phenomenon. Forty to sixty dive sites along the 26 mile coast beckon both the undersea explorer and the non diver who appreciates beauty in aquatic surroundings. Bonaire has a lot to offer from a casino and flamingos to sun worshipping and water, but the thing that brings people back time and time again is the peace, tranquility and friendly environment . . . characteristics of this tropical paradise.

FACTS—Land area: 112 sq. mi.; Status: Netherland Antilles, Democratic State; Population: 9,010; Time zone: Atlantic; Languages: Papiamento, Dutch, English and Spanish.

TRANSPORTATION—Air: Flamingo Airport is served by ALM Antillean Airlines from Aruba, Curacao, as well as one weekly non-stop flight from Miami. Transfers: to downtown approximately $3 by taxi. Rental Cars: Major and local companies. Entry Requirements: Proof of citizenship and return ticket. Currency: US$1=NAF 1.77 Dutch guilder.

WEATHER/DRESS—Average daily temperature 82 degrees; average water temperature 80 degrees; average yearly rainfall 22", constant sea breeze provides year round comfort. Casual wear is appropriate during the day and evenings.

FOR MORE INFORMATION—The Bonaire Tourist Bureau has literature covering activities and facilities for visitors. Contact principal offices at:

685 Fifth Avenue
New York, NY 10022
Tel.: (212) 838-1797

Breedestraat Street
Kralendijk, Bonaire, N.A.
Tel.: 8322 & 8649

67 Yonge Street
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CAPTAIN DON'S HABITAT— BONAIRE ISLAND, NETHERLAND ANTILLES

Captain Don's Habitat, Bonaire Island, Netherland Antilles. Phone overseas operator: 8290, telex: 1281 Bontra.

RESERVATIONS: Frank Fennell, P.O. Box 127, Gedney Station, White Plains, NY 10605; (914) 997-7869.

LOCATION—Located on waterfront, 600 yards from Hotel Bonaire. Within walking distance of downtown, 10 minutes from airport.

TRANSPORTATION—Air: ALM Airlines from Miami and Curacao. American Airlines from New York via Curacao. Ground: taxi from airport, $6.00 RIT, major car rentals/Budget and Avis.

ACCOMMODATIONS—Designed as a dive/nature village offering accommodations from two bedroom cottages with living room, kitchen facilities, private bath and porch to economy rooms with bath. Village has restaurant, bar, stereo tape music, dancing area and facilities for 52 divers. Includes full service retail store, darkroom, repair facilities for equipment and cameras. Rates: (year round) single economy $12, double economy $24, two bedroom cottages $48 double, $54 triple, $60 quad. 10% service charge and 5% room tax added to final bill.

DIVING AVAILABLE—

Shallow reef **yes**	Walls **yes**	Drift dives **yes**
Mid reef **yes**	Wrecks **no**	Night dives **yes**
Deep reef **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—3 Mako compressors, 3000 PSI. 130 steel 72 cu/ft tanks. 4 dive boats include three 26' flattops and one 18" wooden pontoon boat. 52' West Indian sloop "GYPSY GIRL" available for charter on request. Rental rates include wts, tank, bac pac $6/day, fins, mask, snorkel $4.50/day, limited wetsuit rental $5/day, BC $3.50/day, regulator $3.50/day. 24 hr. processing, film available.

DIVING SERVICES—PADI, NAUI, YMCA affiliation. 6 instructor/divemasters. 2 day resort course $90, full certification by request $200 periodic U/W photo and medical seminars. Half day diving $21, full day $28. Includes tanks and air. Night dive $8.

DIVING PACKAGES—All pkgs. include basic equip., unltd. air, unltd. shore diving. 6 days/6 guided boat dives $120, 6 days/12 guided boat dives $160. Add 10% service charge on diving package in lieu of gratuities required by law. Dive packages can be prorated. Groups of 10 or more divers, 11th diver is free.

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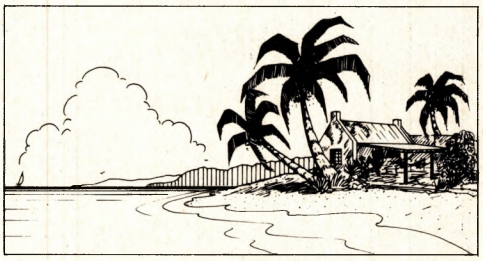
Captain Don's Habitat

The Diver's Village



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(914) 997-7869

CARIB INN— BONAIRE, NETHERLAND ANTILLES

P.O. Box 68, Bonaire, Netherland Antilles. Phone: 8819.

RESERVATIONS: Carib Inn, P.O. Box 68, Bonaire, Netherland Antilles.

LOCATION—Inn is located on the west side of the island facing the ocean, ½ mile from airport and within walking distance of town.

TRANSPORTATION—Air: ALM Airlines from Aruba and Curacao. On Saturday only, one direct flight to Bonaire from Miami. Non-direct flights available at all other times. Ground: taxi from airport $5.00. Rental cars available at hotel.

ACCOMMODATIONS—Four double rooms with two beds each, air conditioning and swimming pool on premises. Refrigerators available for rent. Inn accommodates specific needs for guest including equipment and types of diving. Land tours are available for sightseeing. Watersports include: scuba diving, snorkeling and fishing. Dive shop is located on premises. Inn and dive shop have docks. Rates: $25 (d/o), third person is $7.00 extra. 5% room tax, no gratuities. Travellers checks accepted.

DIVING AVAILABLE—

Shallow reef **yes**	Walls **yes**	Drift dives **yes**
Mid reef **yes**	Wrecks **no**	Night dives **yes**
Deep reef **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—Ingersoll-Rand 5000 PSI. 22 aluminum tanks. 24 Seward dive boat, 200 HP with sincover, ice chest & cooler, maximum 10 divers. Full retail sales and complete rental equipment. Mask, fins and snorkel $3/day, regulator with gauge $3/day, tank, bac pac, weight belt and weights $4/day, air $2.50, U/W camera $20/day. Repairs and parts for scuba equipment and Nikonos.

DIVING SERVICES—PADI, YMCA affiliation. One instructor/divemaster CPR trained. Resort course $50 with gear. Full certification $150 (includes gear and 6 dives). U/W photography and specialty courses including reef ecology available upon request. Cost half day diving (1 tank) $14.50, full day (2 tanks) $25.00. Dive/picnic charters available. Custom design dive trips are available.

DIVING PACKAGES—Packages are tailored to individual specifications and type of accommodations at Inn. Write for details at above address.

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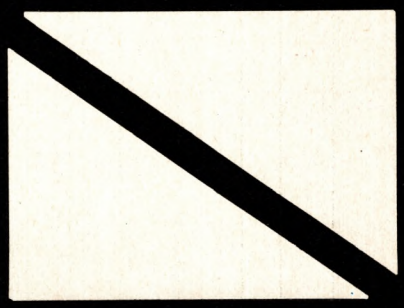

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DIVE BONAIRE/FLAMINGO BEACH HOTEL—KRALENDIJK, BONAIRE ISLAND

J.A. Abraham Blvd., Kralendijk, Bonaire, N.A. Phone: 8285.

RESERVATIONS: Dive Bonaire, P.O. Box 686, Ithaca, New York 14850. Phone: (607) 277-3484, or toll free: (800) 847-7198 (except N.Y. (800) 252-6323).

LOCATION—Resort is 12 acre property located on west side of island on the waterfront. 10 minute walk to town, 5 minutes to airport.

TRANSPORTATION—Air: ALM Airlines has weekly flight from Miami, daily flight from Aruba and Curacao. Ground: taxi from airport $3, car rentals at hotel and airport.

ACCOMMODATIONS—110 air conditioned rooms, all with private bath. 90 rooms have balcony or terrace, 37 with oceanfront view. Resort self sufficient with private beach, 2 restaurants, 2 bars, Jacuzzi, sweet-water pool and boutique. Watersports include waterskiing, fishing, sailing, windsurfing, glassbottom boat and snorkeling. Rates: single $28-38 (summer), $45-70 (winter); twin $30-40 (summer) $50-75 (winter). Major credit cards accepted.

DIVING AVAILABLE—

Shallow reef **yes**	Walls **yes**	Drift dives **no**
Mid reef **yes**	Wrecks **no**	Night dives **yes**
Deep reef **yes**	Caverns **no**	Beach dives **yes**

DIVING EQUIPMENT—3 Bauer compressors, 3500 PSI. 80 tanks 80 cu/ft. 4 dive boats include 3 Bristol 26' flattop Trimarans, 31' Offshore Pirogue with 60+ total diver capacity, 15-passenger bus for beach dives, full service retail store with complete gear rental and minor repairs. Storage area for gear, film in stock. U/W camera $20/day, strobe $15/day.

DIVING SERVICES—PADI, NAUI, YMCA affiliated. One master instructor, 5 instructor/divemasters CPR first aid trained. Resort course $50, full certification $165, U/W photography course available. Cost half day diving (1 tank) $21, full day (2 tanks) $32.50, night dive $11.50.

DIVING PACKAGES—8 days/7 nights. Rate price depends on package; includes tank, bac pac and weight. Rates per person double occupancy. Includes diving, accommodations, 2 meals/day, transfers, all tax and service charge. Group rates available.

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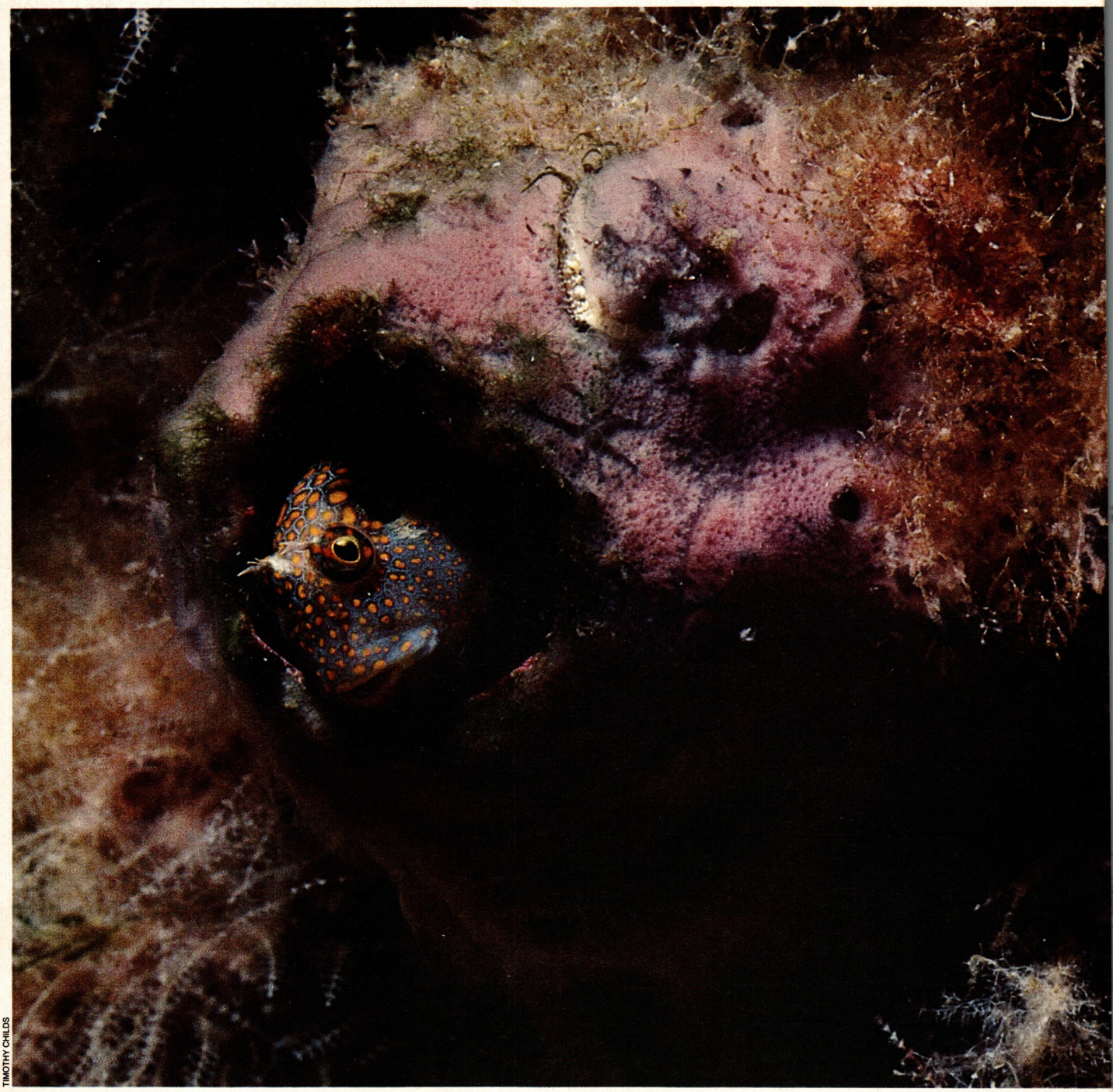
THE AIRLINE OF THE DUTCH CARIBBEAN

Sea Technology:

Flower Gardens Reef

Big Oil and environmentalists square off over a choice piece of Gulf real estate.



TIMOTHY CHILDS

A tiny freckled blenny seeks refuge in a tube sponge on Flower Gardens Reef.

The Flower Gardens Coral Banks are the most beautiful of the few reefs in the Gulf of Mexico. They support growth of tropical corals, fish and other life. Flower Gardens would be a nice place to spend your next diving vacation. You may never get the chance.

BY RO SHEFFE and PHIL TRUPP

Divers named the world's most northerly coral reef Flower Gardens for its beauty and diversity of life forms.

Ro Sheffe is Senior Editor of ***Sport Diver.*** *Phil Trupp is* ***Sport Diver****'s Washington Correspondent.*

continued

Mobil Oil Company calls it Tract A-389.

It's a matter of perspective. Mobil sees beauty and diversity here, too: oil and gas.

Mobil and two other companies are ready. They know where it is and what it's worth. They've picked out the sites and paid the lease. All that stands between the oil and the drill bit is Flower Gardens Reef.

Everyone concerned agrees that it would be a shame to harm the reef. Almost everyone disagrees on the type and extent of damage drilling would cause. The bit can't drop until these questions have reasonably accurate answers. But so far they don't, and the oilmen are getting restless. Patience pays no dividends, and the meter's running on a good bit of very expensive hardware lying idle.

We'll pay for the delay, of course, but we've gotten used to that. Another dime, another dollar, per gallon? We'll pay. The oil industry tells us that's not the issue here. It's not price hikes we have to fear, it's OPEC. What we're *really*

STEPHEN EARLEY

doing out there on that reef is rolling up our sleeves to sweat out some energy self-sufficiency. It's not unpatriotic to burn expensive fuel, just expensive foreign fuel.

So how can a coral reef stand in the way of America's energy needs?

Flower Garden supports a multi-million-dollar commercial fishing industry, for one thing. It is a major recreational feature drawing fisherman and divers from across North America. And since the reef survives at the extreme limits of the corals' tolerance to cold water, Flower Gardens is among the most scientifically valuable reefs in the world.

But the oil underneath could make a contribution to our energy needs, and this is how much: three minutes. At current rates of consumption, that's how long it would take the U.S. to consume the total amount of oil beneath Flower Gardens Reef, according to the U.S. Geological Survey.

Symptoms of Drilling Disease

The two aspects of drilling most likely to injure or kill the corals of Flower Gardens have harmless names: mud and water. The names are deceptive. Drilling mud is a chemical sludge squeezed down the shaft after the bit to lubricate it and flush out cuttings.

Produced water is the industry's term for pockets of water sealed in geologic formations. When the drill bit punctures the pocket, the water is "produced." Suspended in this water are heavy metal ions including arsenic, cadmium, lead, mercury and zinc. Once produced, they enter the food chain. Some of it is ingested and concentrated by fish; delicious fish in most cases.

Drilling muds (there are dozens of kinds) have more potential to injure corals. Exactly how much is not known. The companies that make the muds won't say what's in them, fearing the recipe will be stolen by competitors. Some of the *kinds* of materials the muds contain are bactericides, corrosion inhibitors, lubricants, thinners, reducers, foaming agents, dispersants and caustic acids.

Assuming the oil lies 10,000 feet down, between 3000 and 7000 barrels of this mud will be needed to drill each well. Twenty to 40 wells will be drilled on each tract, and three companies have licenses to drill one tract each.

Attempts to measure the extent of damage this much drilling mud could cause have been very few, and have produced wildly varying results. The question is how close to the reef can the companies drill without causing permanent damage. The answers, based on existing studies, range from one meter (39 inches) to 12 nautical miles.

Because the reef is already subject to many natural stresses, any effects from drilling mud will be much more pronounced. Winter water temperatures normally drop to within two degrees of the corals' absolute tolerance to cold. The reef is deeper than most of its kind—80 feet to 160 feet—and its need for sunlight can be met only because of the extraordinarily clear water that prevails in this part of the Gulf. Aside from the unknown toxic effects of drilling mud, just the plume released from a drill rig as discharged mud diffuses into the water can dramatically alter the normal clarity of the water. Pick out your least healthy houseplant, place it in a closet and cover it with soot. You get the idea.

Under the lease program, the Department of the Interior must assess the environmental impact of drilling, and make sure potential damage is identified and minimized before drilling can begin. Interior turned the job over to the Bureau of Land Management. BLM contracted the National Oceanic and Atmospheric Administration to do it. The General Accounting Office looks over NOAA's shoulder to make sure it gets done. Some of the more flattering remarks GAO made after an expensive and careful review of the way NOAA has handled the job are "unrealistic" and "hopeless."

The National Academy of Sciences conducted its own investigation and agreed. The loopholes in the program were so large and so many that the reef could be killed many times over in strict compliance with the environmental safeguards.

There remained one chance—a law drafted by Congress in 1972 designed to actually *protect* valuable marine ecosystems from this sort of destruction.

And that's just what the Marine Sanctuaries Act does. When a huge oil spill off the California coast ten years ago left beaches reeking with the corpses of marine creatures, Congress decided enough was enough. There are precious few unique marine areas, and no amount of existing legislation could assure their survival. Congress wanted a no-bullshit law, and that's what was enacted.

The Act now protects two marine areas—one in Florida waters, one off North Carolina—and six more are proposed. But never before has the Act come head to head with Big Oil over a living reef system. And now it's Big Oil that has decided enough is enough. They're through playing games with government agencies and environmentalists over this reef. They want the oil, and the big guns are moving into place. When the smoke clears they expect to see not only Flower Gardens Reef open to drilling on their terms, but the Marine Sanctuaries Act disarmed.

The first shot was fired by Congressman John Breaux from Louisiana who has submitted a bill calling for repeal of the Act's ability to protect unique and valuable marine areas.

No one doubts the value of Flower Gardens, certainly not Rep. Breaux. But to some, value means immediate dollar profit. Some of us see it differently.

It's just a matter of perspective.

And three minutes' worth of oil.

The Congressional Reef

Congressman John B. Breaux has a dream: to cut out the waste of hard-earned, inflated tax dollars, especially when those dollars are being tossed to the wind like so much confetti by big government.

Breaux's dream isn't new. The Louisiana Democrat has always believed in watching out for the taxpayer because, really, the taxpayer is an overburdened wage earner, or a small businessman trying to make a go of it against rules and regulations which seem more to discourage his independence than to promote it. John B. Breaux understands such things.

And, for the diving community, it's good to know he's on our side — one of the few certified divers in Congress — and he can feel the importance of the oceans, has sensed first-hand its essential role as a life-giving benefactor.

However, about nine months ago

continued

Mr. Breaux introduced a bill, HR 5018, which asks Congress to repeal Title III of the Marine Sanctuaries Act of 1972. Title III allows the Secretary of Commerce to designate sanctuaries, subject to state and Presidential approval.

Now Mr. Breaux isn't short-sighted or arbitrary; he simply wants to cut unnecessary government spending. That, to him, means the $2.5 million NOAA needs to handle its current programs *including* the often arduous process of finding new sanctuary possibilities, studying them, debating them with numerous state and industrial interests, protecting these areas from encroachment, exploitation and the oil industry.

Many people in Washington and elsewhere feel $2.5 million isn't outrageous at all — that it buys a very worthwhile national product.

According to Wayne Smith, a close administrative aide to the congressman, Mr. Breaux has been studying the sanctuaries program (he refuses to call it a "boondoggle") for three years.

"Existing statutes already cover it," he says. "NOAA's power cuts across too many other agencies and jurisdictions."

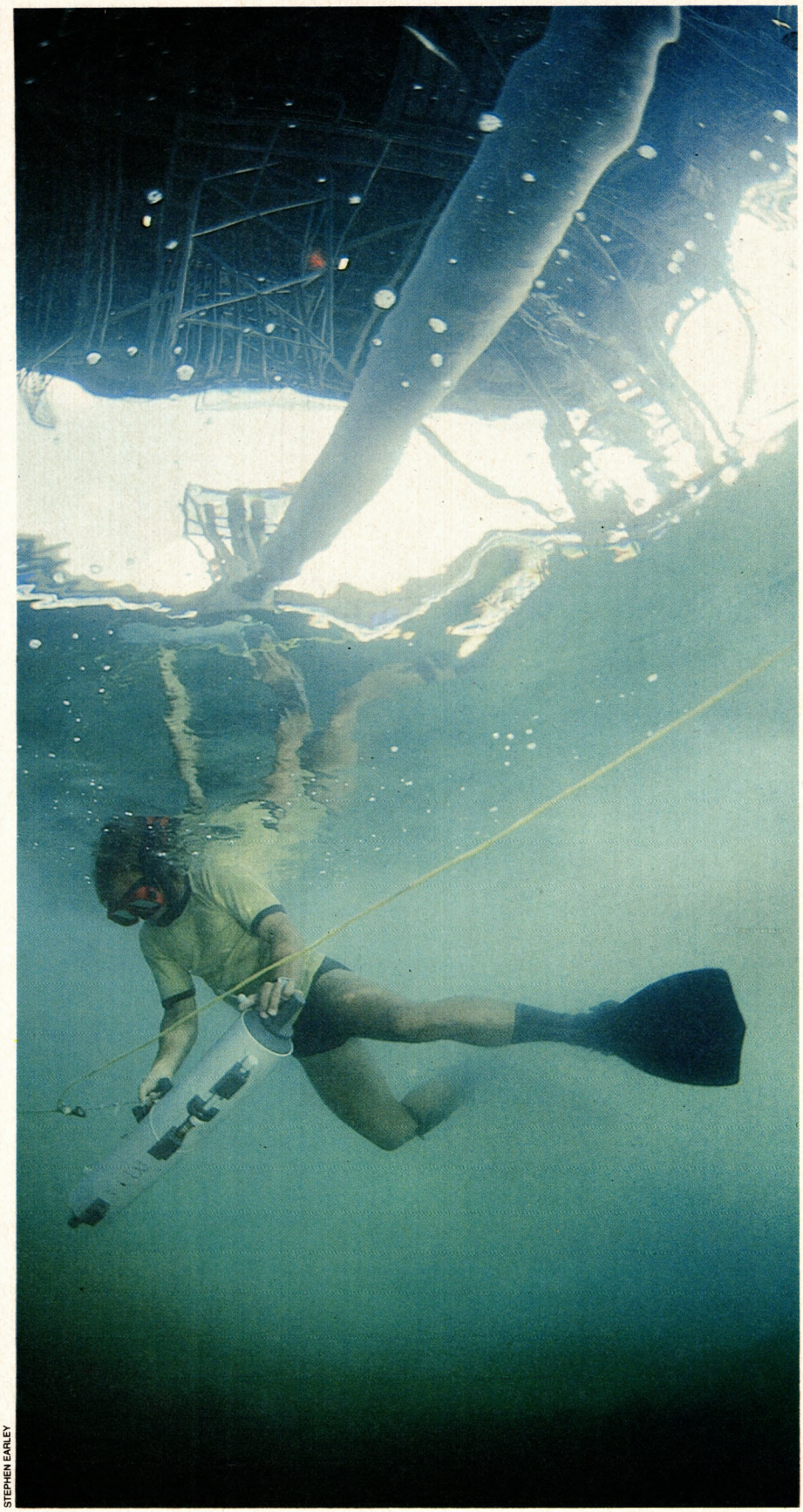
He says that laws protecting marine mammals and inland waterways, outlawing negligent oil spillage, and regulating a variety of interrelated activities are on the books now, and that it doesn't make sense to spend more money — even if it is used in part to oversee the *Monitor* and Key Largo.

"He's *very* serious, very concerned about this," Mr. Smith says.

That much is obvious. Mr. Breaux hired the prestigious Congressional Research Service, an arm of the Library of Congress, to study the issues. The study cost many thousands of tax dollars, but then Mr. Breaux isn't the sort of man to propose killing off an entire national program without a few facts.

But the CRS study, released in February 1980, failed to reach conclusions appropriate to Mr. Breaux's purpose. CRS polarized the issues by concluding that the sanctuaries program "offers a positive approach" to a well-defined national need.

And, says CRS, the act isn't duplicative, doesn't trample existing laws, and offers the kind of broad protection lacking in a linear law such as the Marine Mammal Protection Act. The Marine



STEPHEN EARLEY

Only exceptionally clear water sustains Flower Gardens Reef's tenuous hold on survival. The mud plume being sampled is discharge from a drill rig near the reef.

Sanctuaries Act is bigger than that, and it fills the gaps which Mr. Breaux says do not exist.

But Mr. Breaux came back strongly, arguing that the CRS — a civil service equivalent to the Brookings Institution — failed miserably to be objective.

Mr. Breaux is a very dedicated and patriotic man, and it is well known that he believes in this nation's goal of energy self-sufficiency. But when CRS informed him that their conclusions *did* take into account these very sentiments, and that it still believes Title III is a good, necessary law, a law that in no way defeats our energy goals (whatever they may be), Mr. Breaux flared up. He claimed CRS was guilty of "faulty" scholarship. And perhaps he was a bit passionate in his criticism. CRS, smarting under the attack, is now writing still another report backing its initial conclusions.

Wayne Smith says the congressman is no pussy cat. He isn't going to be put off by a gaggle of academics and conservationists. He's going to see it through, and he certainly can't be accused of siding with the offshore industries simply because he's from an area in which offshore development amounts to billions of dollars. If Mr. Breaux has consistently voted with these industries on every issue, it doesn't mean he's anything but objective, concerned, a foe of waste and duplication, as every good citizen should be.

"He's very sincere," Mr. Smith says.

No one ever doubted it. Well, maybe a few doubt it — just a few.

For instance, the Center for Law and Social Policy, a coalition of the major conservation forces, states that Mr. Breaux's position on the Marine Sanctuaries Act "parallels in almost every way" the positions stated by the offshore oil and gas developers.

Clifton E. Curtis, attorney for CLSP's International Project and coordinator of the sanctuaries battle, says Mr. Breaux's stance against the CRS study "is indicative of his approach."

Mr. Curtis suggests the congressman isn't focusing on the merits of the study — "what the study really says."

But Wayne Smith says that's absurd. Just because Mr. Breaux sees glaring flaws doesn't mean he isn't perfectly straight arrow. Even if CRS had favored his position, the congressman probably

continued

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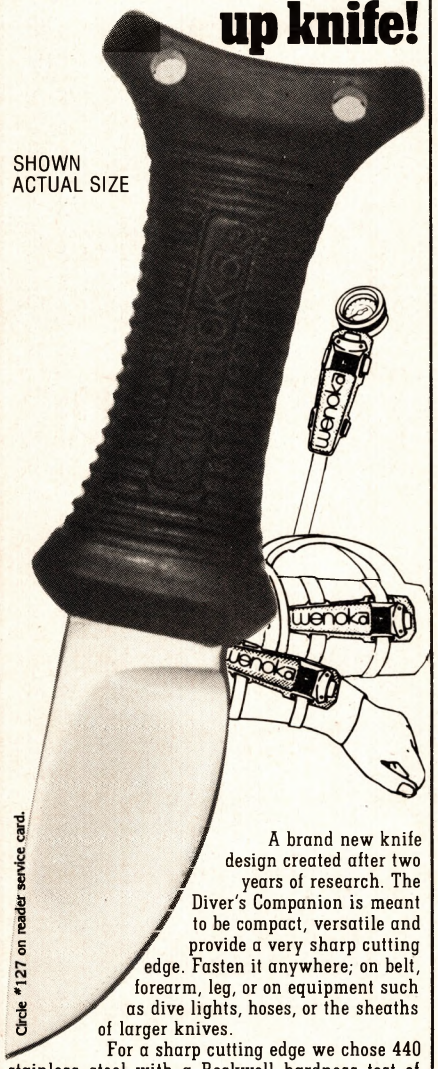

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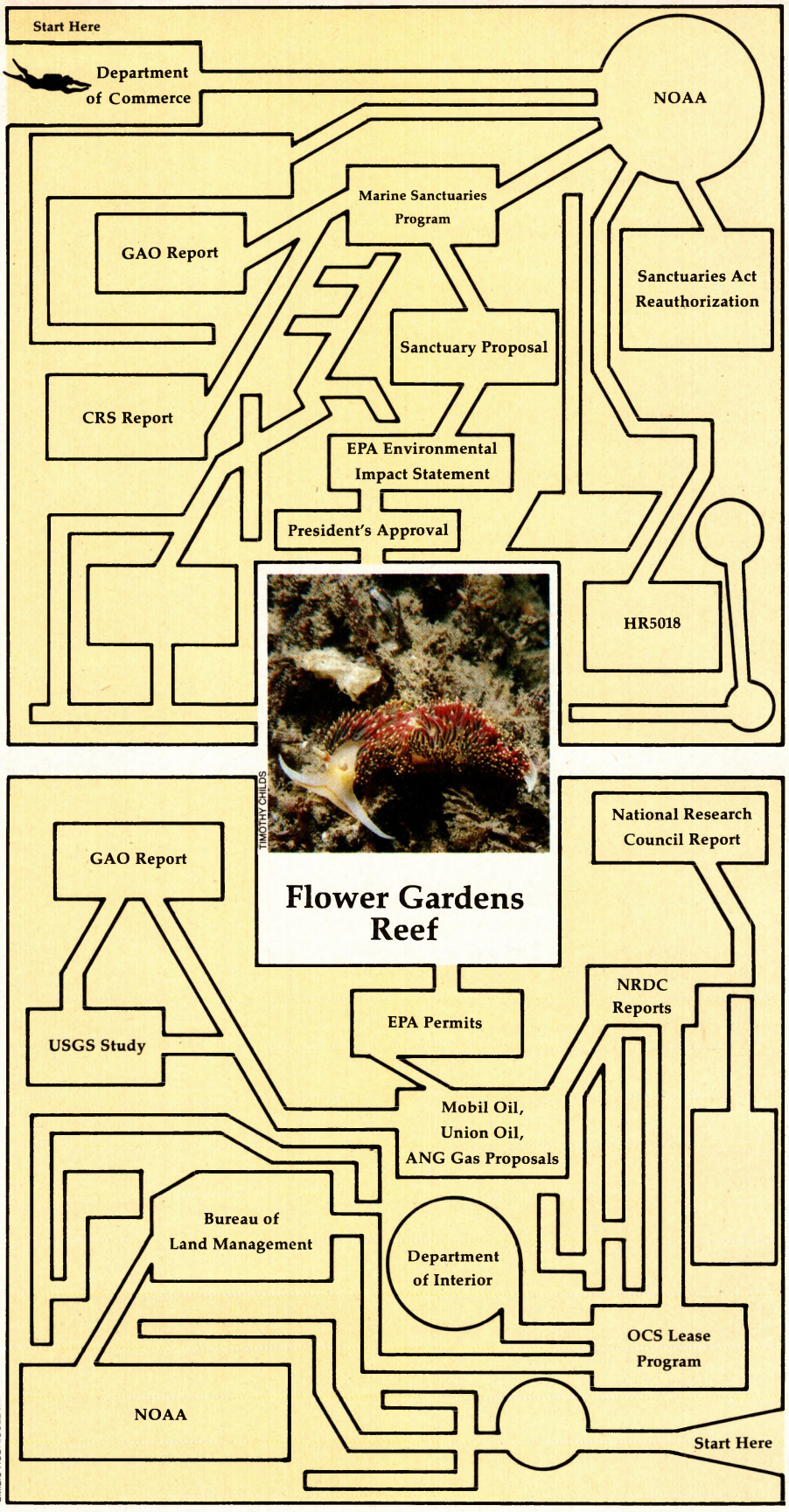

Confused? So is everyone else. Sportsmen, divers and conservationists are using the Marine Sanctuaries Act to try and stop drilling allowed by the OCS Lands Act. The regulations, laws and administrative rules governing the fight are endlessly overlapping and conflicting. You can bet Big Oil has its highest-paid lawyers deciphering the law while its politicians attack the exposed flank–the Sanctuaries Act. The whole conflict now hinges on who the EPA believes regarding drilling and coral damage.

would have made a public issue of its failings anyway. That's how elected officials are: Anything to get at the truth.

Mr. Breaux knows the truth, too, and he isn't giving up. And it doesn't matter that dozens of prominent conservationists allege he is in sympathy with the exploitative side of the issues, or that he has openly opposed a score or more conservationist measures, such as insisting that the Endangered Species Scientific Authority lose its independence and be placed under the veto power of the Secretary of Interior — a move in which he was successful.

Recently, a group of influential congressmen signed a joint letter opposing H.R 5018, and some of these lawmakers sit with Mr. Breaux on the House Subcommittee on Fisheries, Wildlife Conservation and the Environment, which he chairs.

The letter, dated February 19, says:

"The Marine Sanctuary Program is a congressional response to what the world has come to realize — that there are places of special and irreplaceable biologic and ecologic value in the ocean waters. Jacques Cousteau has called them 'oases' and, indeed, they are spots of such richness and beauty that the remaining waters may appear as barren as a desert by comparison..."

The letter also points out that the Marine Sanctuaries Act requires NOAA to act in direct response to state decisions. If a governor doesn't want a sanctuary in state waters, NOAA has no choice but to back off.

The General Counsel of the U.S. Commerce Department, Homer E. Moyers Jr., takes an equally strong stance.

In a January 28, 1980, letter to Rep. John M. Murphy, chairman of the House Merchant Marine and Fisheries Committee, which must pass on NOAA's Title III funds, Mr. Moyers says the need to protect certain ocean areas from the harmful effects of offshore development was stressed by President Carter three years ago, when he directed the Secretary of Commerce to gather data on areas where sanctuaries might be needed.

The non-regulatory aspects of the program, he adds, are also significant.

"This program performs an educational and informational function which enriches the experiences of the public and which increases long-term protection by increasing the level of public awareness of the value of the resources and the potential for harm..."

And, finally, the Marine Sanctuaries Act "provides a necessary balance" to an expanding ocean development program, Mr. Moyers says.

None of this has swayed Mr. Breaux. It isn't like him to be so easily taken off the scent.

Michael Glazer, assistant administrator of NOAA's Office of Coastal Zone Management, which administers the Title III program, doesn't think H R 5018 is a serious threat — not for the moment. The House Merchant Marine and Fisheries Committee has voted to continue the sanctuaries act, and that is a very large asset.

"It [the act] will survive and prosper," Mr. Glazer predicts. "And in the next 12 months it will prove itself."

He says that within a year NOAA will have expanded the number of marine sanctuaries from two to perhaps seven. Under study now are the Santa Barbara Channel Islands in California; Looe Key Reef off Big Pine Key, Florida; Gray's Reef, off the coast of Georgia; a reef system in St. Thomas, U.S. Virgin Islands; and the Texas Flower Gardens — a unique coral outcropping off the coast of Rep. Breaux's home state, and a prime area watched by offshore developers.

"The money isn't being wasted," Mr. Glazer insists. "We're geting a lot out of it."

The issue of Title III will be back. Everyone agrees. Mr. Breaux doesn't give up.

Fran Lipscomb, of the Society for Animal Protection Legislation, believes H R 5018 was a trial balloon, a testing of the waters for a later comeback by the congressman from Louisiana.

"He's persistent," she says.

Mr. Breaux believes in economy in government, sound fiscal policy, jobs, good schools, a break for the little guy. And he just can't see how any of these goals can be realized with Title III on the books — and neither can his friends in industry.

But perhaps those of us in the oceans community will be waiting for Mr. Breaux. And we may even have cause to wonder if his sincerity, dedication and spirit of self-sacrifice may be just a little too hazardous to those who believe in the sea.

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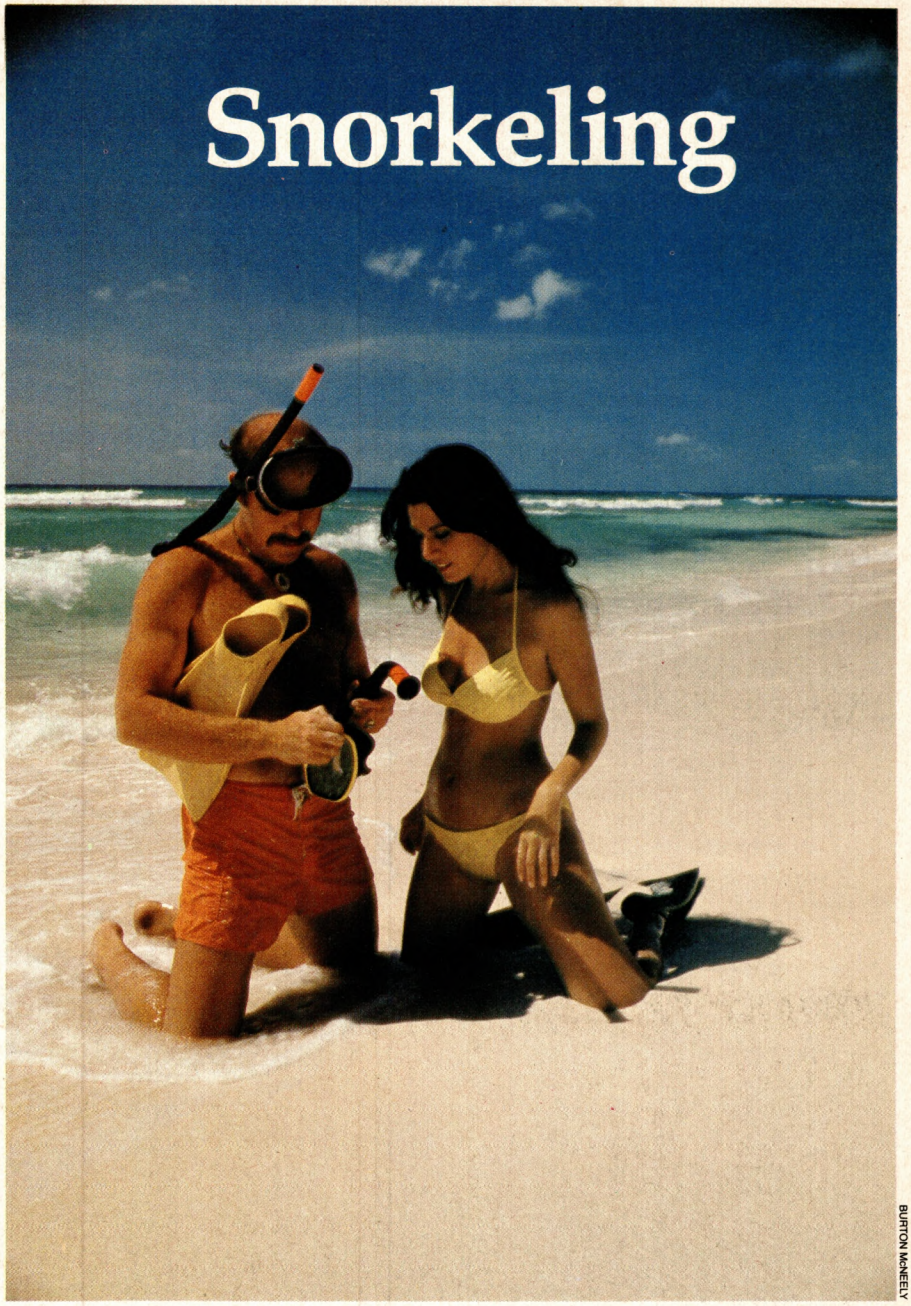


BURTON McKEELY

Leave the bubble machine at home, bring someone you love, and rediscover the simple joys of shallow sightseeing.

BY JON HARDY

ILLUSTRATIONS BY EZIO MATTASSI

Somewhere along the way from pool training to the reefs, many scuba divers have missed the enjoyment of snorkeling. As a diver, you have an excellent opportunity to discover the rewards for yourself *and* to introduce friends to the joys of the silent world through snorkeling.

We have a very specific word for diving with compressed air — scuba — but there are many names for diving without it. Snorkeling has been known as breath-hold diving, free diving, skin diving, snorkel diving, snorkel swimming and surface swimming. Contributing to the confusion is the issue of just what activities are covered by each label. Some people enter the water with mask, fins and snorkel and stay on the surface while swimming. Others hold their breath, dive down and spend some time underwater.

All of these activities, and all sportdiving activities done without scuba equipment, can be referred to as snorkeling.

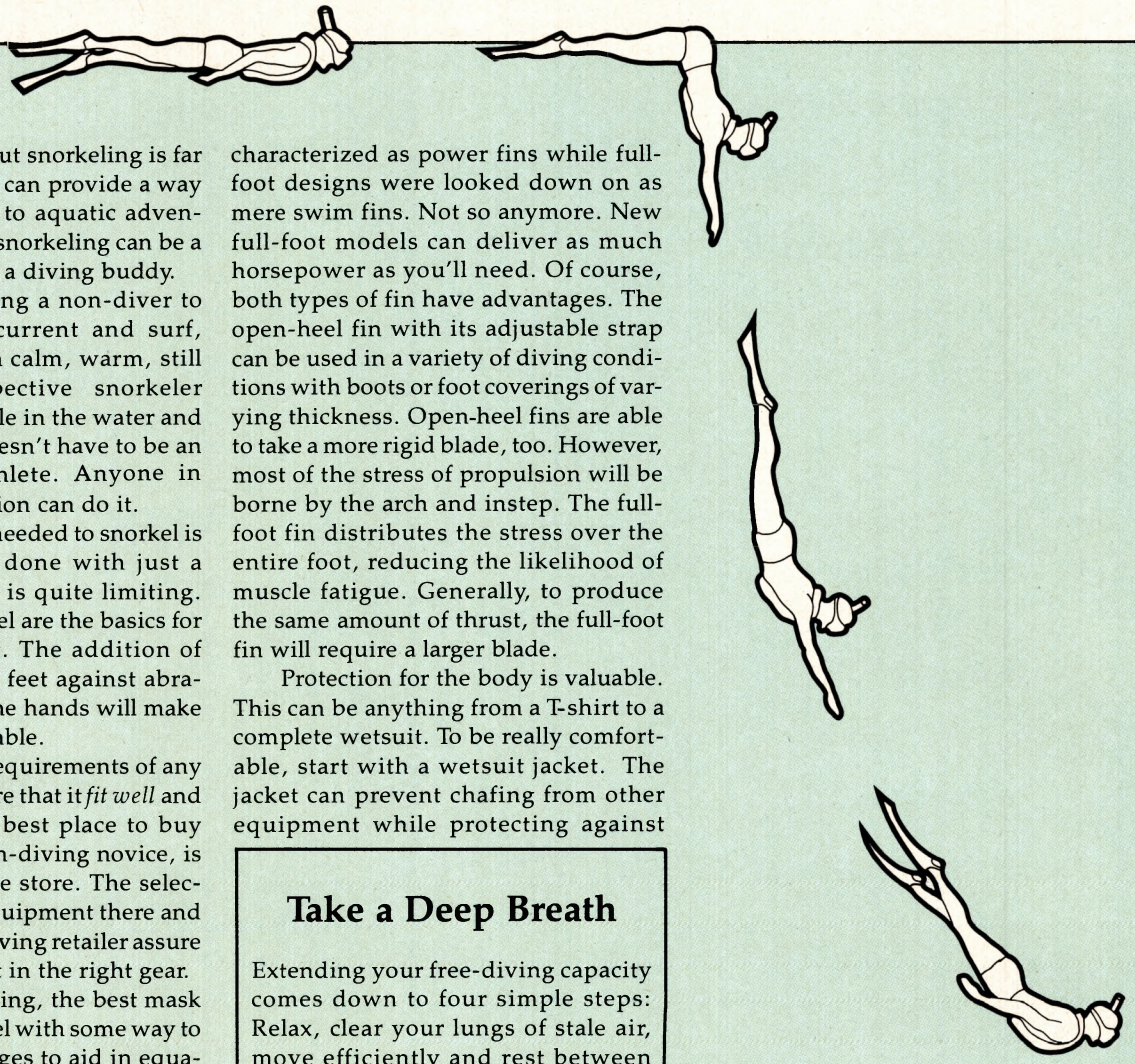
Snorkeling can be thought of as both a sport unto itself and as a prerequisite for scuba diving. All of the skills and equipment used in snorkeling are also used in scuba. In practice, many scuba instructors teach snorkeling techniques as mere adjuncts to scuba skills, without emphasizing the intrinsic value of snorkeling as a skill and a sport. Fact is, being a better snorkeler will make you a better — and safer — scuba diver.

You can snorkel anywhere you can swim. You can do it from a dock, a boat or from shore. It is easier than scuba, and it's learned more quickly, is less expensive and safer. It's also more comfortable as there's less gear to wear and is freer and quieter.

As a diver, all you need do to improve snorkeling skills is to take mask, fins and snorkel out and practice. To make it more interesting, try taking along a non-diving friend. This should be done under controlled conditions and should include only the use of snorkeling equipment — *no scuba*. The training of a scuba diver carries far too much responsibility for you to attempt to train

continued

Jon Hardy is former executive director of the National Association of Underwater Instructors. He is also a diving consultant and author of ***The Business of Sport Diving*** *and Jeppesen's* ***Advanced Activities Sport Diver Manual.***



someone on scuba. But snorkeling is far easier and safer, so it can provide a way to introduce friends to aquatic adventure. Taking a friend snorkeling can be a good way to develop a diving buddy.

When introducing a non-diver to snorkeling, avoid current and surf, using locations with calm, warm, still water. Your prospective snorkeler should be comfortable in the water and able to swim, but doesn't have to be an Olympic-caliber athlete. Anyone in reasonably fit condition can do it.

The equipment needed to snorkel is minimal. It can be done with just a mask, although this is quite limiting. Mask, fins and snorkel are the basics for effective snorkeling. The addition of boots to cushion the feet against abrasion and gloves for the hands will make things more comfortable.

The two prime requirements of any piece of equipment are that it *fit well* and be *comfortable*. The best place to buy gear, even for the non-diving novice, is in a professional dive store. The selection and quality of equipment there and the expertise of the diving retailer assure you'll get the right fit in the right gear.

For most snorkeling, the best mask is a low-volume model with some way to block the nasal passages to aid in equalizing. As you descend, the mask will be pressed against your face by the pressure. You will have to release some air through your nose into the mask to relieve the pressure. A low-volume mask has a small internal air space, therefore it takes less air to relieve the pressure letting you save more in your lungs for the dive. Finger pockets or some other way of squeezing shut the nose will allow you to equalize your ears on descent.

The snorkel should be the simplest smooth curve possible. It should offer minimum breathing resistance with an adequate diameter for the user. Each person's lung capacity and intake ability are different, and a different diameter snorkel is appropriate for each. Ask the professional diving retailer to recommend a size and style of snorkel for you.

In a fin, you'll need the most efficient and well-constructed fin you can afford. Open-heel fins have been characterized as power fins while full-foot designs were looked down on as mere swim fins. Not so anymore. New full-foot models can deliver as much horsepower as you'll need. Of course, both types of fin have advantages. The open-heel fin with its adjustable strap can be used in a variety of diving conditions with boots or foot coverings of varying thickness. Open-heel fins are able to take a more rigid blade, too. However, most of the stress of propulsion will be borne by the arch and instep. The full-foot fin distributes the stress over the entire foot, reducing the likelihood of muscle fatigue. Generally, to produce the same amount of thrust, the full-foot fin will require a larger blade.

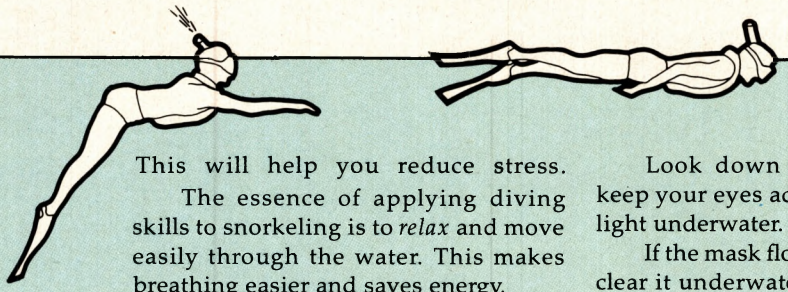
Protection for the body is valuable. This can be anything from a T-shirt to a complete wetsuit. To be really comfortable, start with a wetsuit jacket. The jacket can prevent chafing from other equipment while protecting against cold, providing extra buoyancy and preventing sunburn.

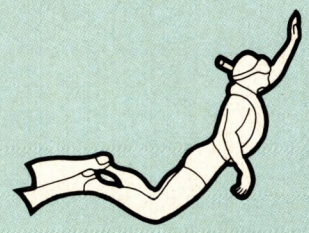
Even though part or all of a wetsuit is used, it's not necessary to supply a beginning snorkler with a weight belt. In fact, it's safer not to provide weights so only surface swimming is possible. Depending on natural buoyancy, an experienced diver can still surface dive even with a jacket and no weights.

Some way to float and rest at the surface is important: part of a wetsuit, a surface float, a vest or a BC. None of these are actually required for snorkeling, but one of them should be employed to give added buoyancy. In some areas, it is important to have a surface float with a flag; in others, a float may create difficulties, particularly if it must be pulled through kelp. If a vest or BC is worn, it should be small and easy to use.

Take a Deep Breath

Extending your free-diving capacity comes down to four simple steps: Relax, clear your lungs of stale air, move efficiently and rest between dives. The more mentally and physically relaxed you are, the better use you will make of the breath you hold. Resting comfortably at the surface, rid your lungs of stale air and replace it with fresh, usable air. Do this by exhaling completely, inhaling, exhaling again and inhaling the breath you will hold. Don't rush your breathing and never take more than three breaths. Any more breaths, any faster may result in shallow-water blackout. Next bend at the waist, lift your legs smoothly out of the water and let their weight push you down. Kick slowly and deliberately once your fins are well below the water. Equalize as you swim, keeping all movements slow and efficient. End your dive at the surface horizontally, then rest for four minutes before diving again. *–Kathleen McHugh*





As you enter the water, some significant physiological changes occur which you should be aware of. These changes include a slowing of the heart rate and respiration and lowered blood pressure — assuming you're relaxed. If you're not relaxed, these same vital signs could increase. Body temperature falls while the center of gravity shifts and body weight decreases to nearly zero. There are also restrictions on movement caused by various pieces of equipment. Vision is narrowed by the mask and water decreases the range of visibility and mutes color. The surroundings are unfamiliar and the added vertical dimension makes orientation more difficult. So some stress is inevitable. For the new snorkeler as well as the experienced diver, it is extremely important to *pause, relax* and *breathe easy.* This will help you reduce stress.

The essence of applying diving skills to snorkeling is to *relax* and move easily through the water. This makes breathing easier and saves energy.

For both yourself and anyone you are introducing to snorkeling, the concept of providing a *margin of safety* is extremely important. Be sensitive to the beginner's level of fatigue or cold. Use as your limit from shore no more than half the distance you believe you can swim just in case you need to help the other person all the way back.

Equalizing the ears and sinuses is just as important in snorkeling as it is in scuba diving. Before each dive, the ears should be cleared on the surface and cleared continuously on the way down. The clearing should be done very gently. If you have trouble clearing, antihistamines (such as Ear Ease) can be used for more safely while snorkeling than while scuba diving.

Snorkel Clearing

The most common way to clear your snorkel after a dive is the "blast" method. This is simply a quick exhale through the snorkel to eject water after you've surfaced. However, this method requires considerable lung power to clear some large-bore snorkels. A better way to do it requires a little more practice but far less effort — the "displacement" method. As you kick toward the surface you should be looking up, and the open end of your snorkel will be angled down. As you near the surface, release a small amount of air into the snorkel. When you break the surface, displacement will force the air pocket down and out the open end of the snorkel, pushing the water before it. The result is at first surprising; water pops out of the snorkel with no effort just as you surface, leaving a clear airway for your first breath almost the same instant your snorkel breaks the surface. *–Ro Sheffe*

Look down while snorkeling to keep your eyes adjusted to the dimmer light underwater.

If the mask floods, do not attempt to clear it underwater, but simply surface and let the water out.

It is acceptable for the beginner to simply drain the water from the snorkel by surfacing and taking the mouthpiece out of the mouth. Beginners should be warned to be sure the snorkel is clear before inhaling deeply.

The snorkel does not have to be attached to the mask, and it can be placed on either side while snorkeling.

On the surface, breathe slowly and deeply through the snorkel, being sure to clear the lungs as fully as possible with each breath.

Kicks should be strong, slow and easy, performed from the hips with the toes pointed. "Bicycle" kicks, with the fins moving forward and back, are of no use in snorkeling. It is also helpful to use the hands when snorkeling — far more than in scuba diving. The hands can be used not only for maneuvering but for propulsion and to hang onto rocks to move more easily on the bottom.

The easiest way to surface is to push up off the bottom and then stay streamlined as possible. Natural buoyancy and momentum will tend to take you efficiently to the surface. It is helpful to look up and slowly spiral 360 degrees as you surface, to be sure all is clear above.

Having a buddy along is just as vital in snorkeling as it is in scuba diving. The buddy is there not only for assistance, but to reduce apprehension and to share in the experience.

Snorkeling is good exercise; it is relaxing and contributes to both good physical and mental conditioning. The special relationship of the buddy pair is not often shared in other sports activities. As an interest in the environment develops, so do feelings for other divers — the interactions and sharing that make diving more enjoyable. Snorkeling is an excellent way to increase your own time in the water and your enjoyment, and one of the few ways you can introduce non-diving friends to your own brand of pleasure.

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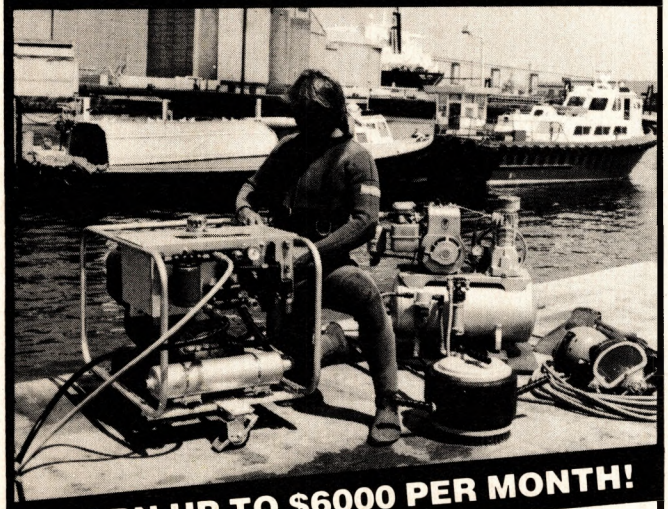

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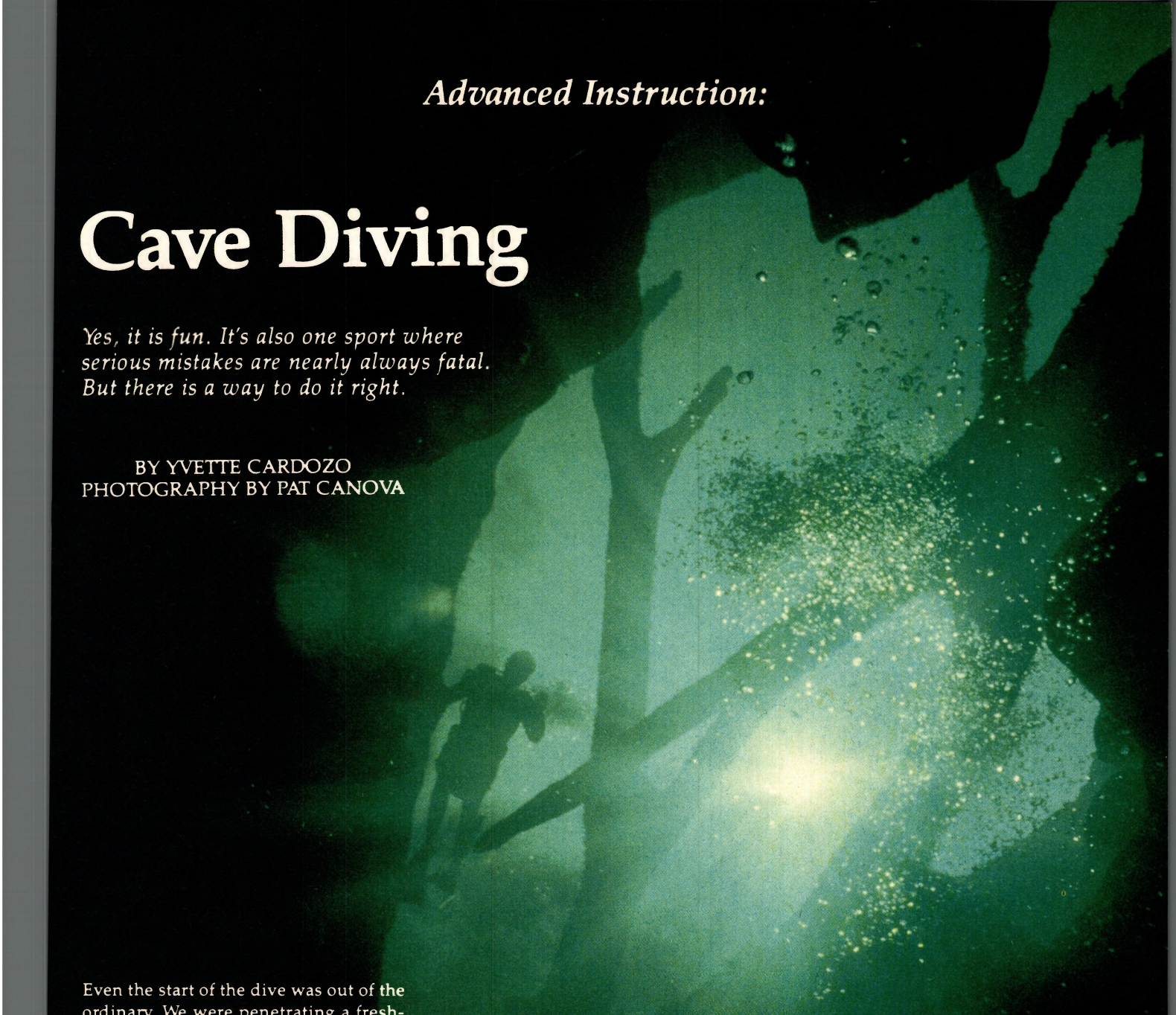
Advanced Instruction:

Cave Diving

Yes, it is fun. It's also one sport where serious mistakes are nearly always fatal. But there is a way to do it right.

BY YVETTE CARDOZO
PHOTOGRAPHY BY PAT CANOVA



Even the start of the dive was out of the ordinary. We were penetrating a freshwater cave in North Florida known as the Devil's Ear—a twisted maze of tunnels which begins with a crack barely three feet by five feet through which flow 42 million gallons of water each day.

I waited briefly on a narrow shelf while the diver in front of me struggled through, kicking up a shower of tiny shells, luminous in the direct sunlight.

The crack opened to a small room where the four of us regrouped before securing a guideline and heading down a mammoth tunnel 30 feet high and 200 feet long. We clung to the right hand wall, pushing along. The water is so clear, I felt I wasn't swimming but flying, an astronaut negotiating the weightless void inside the spoke of a space station.

The passage veered sharply to the right, then narrowed to a crack 30 feet wide and about 30 inches high. They call it the Lips. Beyond, at the end of a large room, were three tunnels. The way through the center was set off by the whiteness of the walls—rubbed clean by countless other cavers. Too soon, one of our party signalled he had used one-third of his air. We turned and followed the safety line back to the entrance.

This was our final check-out for cave diving certification and we all passed—not just by surviving but by carefully following the numerous safety procedures and special techniques outlined during the course.

Formal cave instruction is hardly ten years old. As recently as 1974, before classes began to catch on, 26 people died diving in Florida caves. In 1979, with more active cave divers—and more active instructional efforts—the toll in Florida dropped to three. The classes,

continued

Yvette Cardozo is a regular contributor to ***Sport Diver.*** *Since she completed her cave certification last December, she has been back for five successful cave penetrations.*

Left: A dawn fog enshrouds the mouth of Devil's Ear Spring. Below, right: Little River Spring is one of the many cave systems in North Florida. Inset, top: A complete caver's outfitting runs near $2000. Inset, bottom: Permanent guide line in systems like Peacock Springs begin a few hundred feet inside the mouth of the system.

Opening page: Diver prepares to enter the netherworld in Blue Spring State Park.

which began in Florida, have spread to other parts of the country, particularly the Midwest and Southwest, where caving is gaining in popularity.

Ten or five years ago, instruction in cave diving was scarce and there was a fear among the cavers that classes would only lure more people into the caves and result in more deaths.

That hasn't happened. More people are now caving, but they're doing it more safely. There are a number of courses available, from cavern diving to basic and full cave diving. Cavern diving involves diving in the mouths of caves, within sight of the sunlight outside. Basic cave diving is an entry-level certification that qualifies cavers for short penetrations, hopefully with a more experienced buddy.

"It's become obvious that people who come to Florida are going to go into the water. They're going to go into that hole, sometimes beyond the reach of sunlight," explained National Speleological Society cave instructor Joe Hall. "There's nothing you can do to stop it short of closing the caves off, which nobody wants. So the belief is, let's give them enough training so they can go in and come out under any conditions."

So what is a cave diving course like?

It's tough. There are about 500 people in the U.S. who are certified for cavern or cave diving. Of those cave divers, most had extensive scuba experience and quite a bit of informal cave experience before taking the course. Phillip Janca at Florida's Branford Dive Center has ten people per month in his cavern diving course. Of these, perhaps five will go on to the basic cave course, and only two will complete the full cave course.

Cave diving bears about as much relation to open-water scuba as technical climbing does to rock scrambling. You've got to breathe differently, swim differently, plan differently. Even scuba instructors —at least 15 of them—have died in caves. In most cases they were open ocean instructors not familiar with the specialized techniques of caving.

The NSS textbook, *Basic Cave Diving, A Blueprint for Survival,* begins each of its ten chapters with a case study of a fatal cave accident. A bit melodramatic perhaps, but it gets the point across. "Generally, it's not one mistake they make, but three or four," explained author Sheck Exley. His first case history is an excellent example:

"On May 7, 1978, two young sailors ... arrived at Royal Springs. Neither Jim nor Mike had any training in basic scuba, much less cave diving. They entered the cave without a line and Jim did not have a light or submersible air pressure gauge. After quite some time had passed and the two had not surfaced, a friend became alarmed. The sheriff's department was contacted who in turn called our NSS recovery team. NSS divers quickly found Jim 175 feet back in a small, silty cave at a depth of 30 feet and Mike's body was found some 225 feet further. There was no air in their tanks."

The major problem here, says Exley, was silt. It appeared as if the man with the light was in front with the second man close on his heels. Both were kick-

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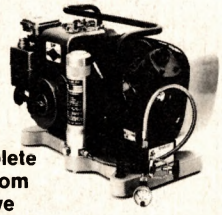

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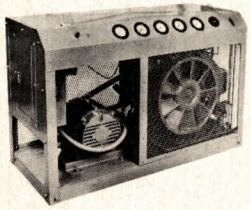

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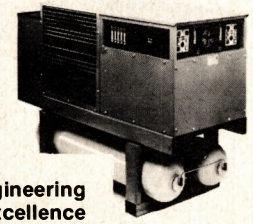

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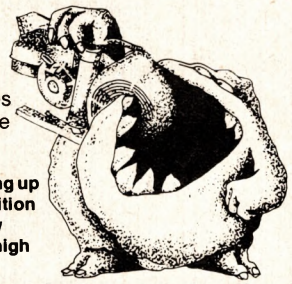

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ing up the deep, powdery mud on the floor. Exley figures the two got separated and Mike did something fairly common to novices—he panicked. Instead of swimming back into the silt, the way he had come, he swam into the clear water, farther and farther from the entrance until he ran out of air. The silt was so heavy particles of it were still hanging in the water when the NSS team arrived 24 hours later.

Probably the largest single cause of cave accidents is the lack of a continuous guideline to the surface. Cave line is nylon (plastic floats and tangles easily) and thin (because you only need a guide, not something to pull yourself along with). It's wound on a reel. There are permanent lines in some of the most popular caves, but these usually begin at least several hundred feet from the entrance, and often have large gaps in the middle where the caves branch off. Those few hundred feet are plenty of space for a diver to become confused and lost.

The first day of our eight-day course, we went into a shallow basin and tried following a line which was looped around various rocks. This was made tougher by the fact we were not only buddy breathing on a single regulator, but had to take one turn around with foil blacking our masks. In a basin it's frustrating to wind your way around endlessly, only to realize you've turned 180 degrees on some rock and are back where you started. In a cave, if your light should fail, such a mistake could easily be fatal.

Cave divers religiously follow the *one-third rule of air consumption*. You use only one-third of your air going into the cave, reserving one third to return and the final third for emergencies.

There's also the matter of back-up equipment—another missing link in the fatal textbook dive. In cave diving, every piece of equipment has at least one back-up. You dive with double tanks linked by a dual valve manifold. Either valve will feed air from both tanks. You carry two complete regulators; not only two second stages, but two first stages as well. Some divers wear dry suits, which can be used as back-up buoyancy compensators. The tanks are heavy, so buoyancy—to stay up off the bottom and out of the silt—is very important. And while textbooks recommend three lights (a primary light of at least 30 watts and 50 minutes' burn time, plus two strong

The tin foil blackout allows caver's to test their skills of following guide lines without sight.

Equipment

The stuff you'll need to begin a caving course is a little different, and a little more extensive, than basic open water gear.

For Cavern Diving:

Low volume mask, power fins (no snorkel because it snags on lines) ($75).

Full wetsuit ($200).

Single 72 cu.-ft. tank or larger ($125).

Single-hose regulator with primary and octopus second stage ($275).

Pressure gauge ($65).

Two dependable underwater lights ($100 - $160).

Buoyancy compensator with auto inflator ($150 - $270).

Dive knife (small, sharp), slate and pencil, dive tables ($30).

Watch, depth gauge, compass ($230).

Nylon guideline 1/16- or 1/8-inch on dive reel (one per party) ($60).

For Cave Diving (following modifications):

Dual tanks with dual valve manifold (crossover bar or dual single tanks not acceptable) ($350).

Two full first and second stage regulators of top line quality with primary second stage on five-foot hose (e.g.: Scubapro Mark V, Submarex Atmos, Poseidon Cylon 300 ($400).

Third underwater light (one must be at least 30 watts and have a minimum 50-minute burn time. Serious cavers use homemade or privately built liquid nicad battery lights which can be charged in 40 minutes on car batteries. Ikelite's Superlite with quick charge modification is the bare minimum sold commercially). Nicads ($250). Superlite with quick charge ($190).

Total for cavern diver: approximately $1300. Except the guideline reel, most gear should be part of regular scuba gear.

Total for cave diver: approximately $1900.

secondary lights), most cave divers also carry an extremely reliable fourth light, such as a Tekna or Q-Lite.

Being without a way to see is one of the spookiest possibilities of caving,

continued

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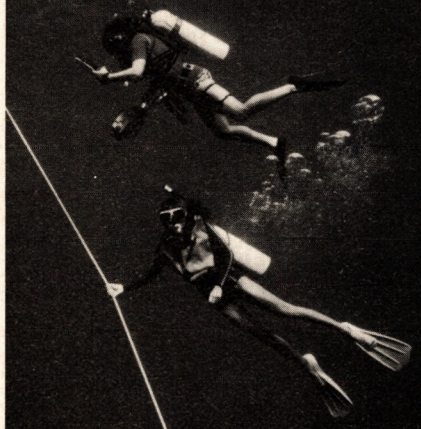

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PHOTO BY RICK FREHSEE

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Basic Safety

The NSS publishes a pamphlet that covers the most rudimentary aspects of cave diving. It is *not* intended as a guide to complete caving or to be taken as a full course of instruction.

1. Always reserve two-thirds of your starting air supply for the trip out of the cave. This rule applies best to teams utilizing similar tank configurations and air pressure. Do not begin a dive with less than 1500 psi and monitor your submersible pressure gauge constantly.

2. Always run a single, continuous guideline from the cave entrance throughout the dive. Secure the line in open water and again within the cave entrance to prevent removal by swimmers or open water divers.

3. Avoid deep diving in caves. The average depth for fatal dives in which the first two procedures were followed was greater than 150 feet. Confine your cave dives to depths less than 130 feet and cavern dives to 60 feet.

4. Become proficient in emergency procedures by practicing them in open water prior to the dive. Practice buddy breathing with each new team member and before the first dive of the day with each buddy. Practice other emergency procedures regularly.

5. Avoid panic by knowing and observing your own limitations and by building up experience slowly. Never depend on another diver's ability to carry you through the dive. The dive must not exceed the limitations of the least experienced diver.

6. Avoid silt by using your buoyancy compensating device to stay near the cave's ceiling. Check behind yourself frequently to insure silt is not being stirred up.

7. Stay within arm's reach of the guideline and maintain visual contact with it at all times. If visibility is poor, maintain hand contact but do not pull on it.

8. Avoid passageways you cannot turn around in easily.

9. Stay near your buddy at all times and watch for his signals (dipping the light is a common signal to get attention). Should difficulties develop, notify your buddy immediately and exit the cave together.

and takes up a large part of the training. Towards the end of the course, we had a chance to try blacked-out masks again, this time in a cave. Three of us positioned ourselves on a line 300 feet back in Devil's Ear. We would have to thread our way through the Lips, then navigate a sharp left turn before entering the open stretch of main cavern leading to the surface. The idea was to keep one hand on a buddy and the other on the guideline. What began as an orderly procession ended in confusion at the Lips, a mass entanglement of feet in faces and flailing arms. We somehow managed to unknot and regain our proper contacts before we reached the exit, but it wasn't easy.

Because silt can cause a blackout nearly as thorough as light failure, we spent a lot of time learning proper silt techniques. In most caves, the proper position is to hold the head down and the feet up (opposite that of most ocean divers) while kicking off the ceiling with the feet or pulling along the sides with the hands. Some people also finger walk (holding their bodies and feet still while pulling along with the fingers) or fly walk (hang upside down near the ceiling and pull along it). All of this is done very carefully so as not to damage the fragile limestone tunnels.

The bottom line of the caving course is to prevent panic by practice, and more practice. We tried buddy breathing and a buddy rescue drag. We ran lines. We tied lines. The day we began our class, instructor Bill Oigarden and a friend buddy-breathed more than 300 feet in Devil's Ear just to keep their technique up. "You've got to be prepared for anything," Oigarden said, "It's a good idea to regularly flood your own mask to become comfortable with the feeling in case somebody kicks your mask off. And reach for your other second stage occasionally to take a few breaths off of it."

As for the style of the equipment, it also differs from open ocean stuff. The mask is low volume, low drag. Wraparounds are not advised. The fins are open-heel power types with the straps taped to keep them from tangling in the guideline. Spare lights are clipped to the tanks. The knife is small, razor-sharp and worn on the arm. All gauges are also worn on the arm since a console is not only hard to find, it tends to tangle in the line. The pressure gauge goes through the arm of a stabilizing jacket or through the tank strap to hang inches away from

Certification Agencies

National Association for Cave Diving (NACD), PO Box 1518, High Springs, FL., 32643. Offers cave diver certification.

National Association of Underwater Instructors (NAUI), PO Box 630, 22809 Barton Rd., Colton, CA., 92324. Cave diver certification.

National Speleological Society (NSS), Cave Diving Section, F.M. Wilson, 2832 Concord Dr., Decatur, GA., 30033. Cavern diver, basic cave diver, cave diver certification.

Professional Association of Diving Instructors (PADI), 7212 Eudine Dr., N., Jacksonville, FL, 32210. Cave diver certification.

Young Men's Christian Association (YMCA), PO Box 1547, Key West, FL., 33040. Cavern certification.

Bibliography

Basic Cave Diving, A Blueprint for Survival by Sheck Exley, published by Cave Diving Section of NSS ($2.95).

Cave Diving Safety Brochure. published by Cave Diving Section of NSS (free).

NSS Cave Dive Manual, published by Cave Diving Section of NSS.

Hand Signals for Cave Diving by Claudette Finley, published by NACD ($1).

El Cheapo Book of Home Brew Cave Diving Equipment by Tom Cook, published by Cave Diving Section of NSS ($5).

Diving Guide to Underwater Florida, edited by Ned Deloach, published by New World Publications, Jacksonville, FL. ($3.95).

the waist. A compass is imperative. If a cave silts up it can show you the way out. An easy-breathing piston first stage is a must.

There were some other tips. The weakest diver goes in the middle (cave buddy teams usually have three members). If a buddy gets tangled in the line and it breaks, you scramble for the outflowing line, since it is the ticket out for both of you. And a dive can be abruptly ended by anyone for any reason including "I don't feel right about this dive."

Cave diving can be a ticket to other-worldly experiences or straight through to your next life-cycle. The only way to enter a cave is knowing that you'll come back out because you've been *trained* to do it right.

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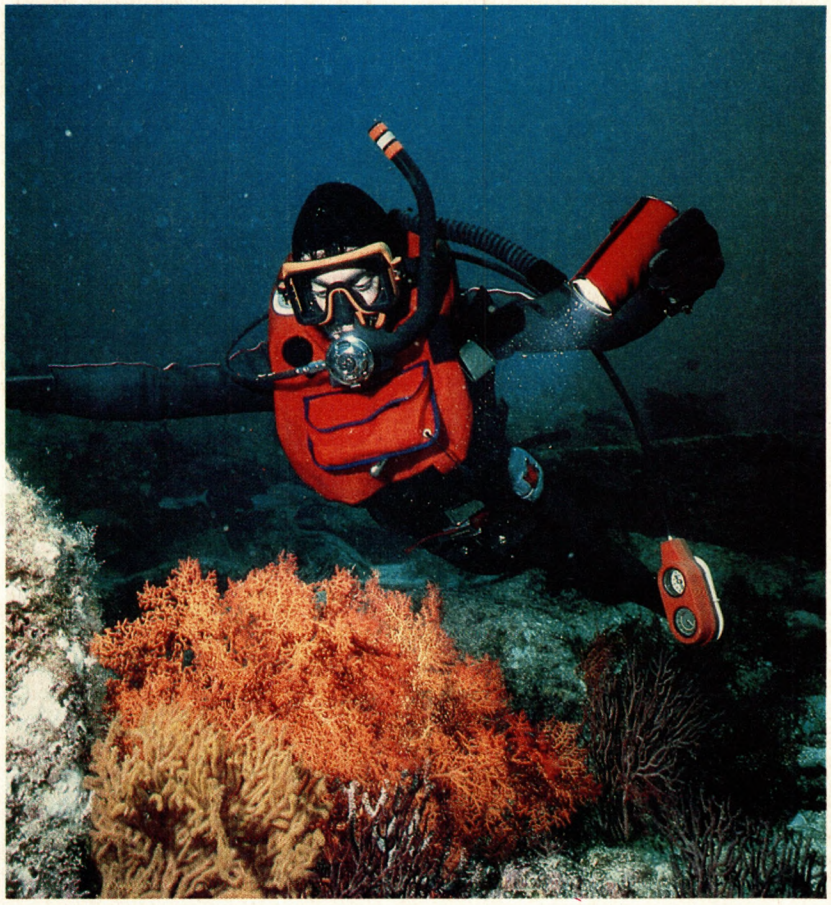
The Sea of Cortez

Four centuries ago, the Spanish came here looking for gold and struck out. Now divers find the Conquistadors were simply looking for the wrong kind of treasures.

BY CARL SISSKIND
PHOTOGRAPHY BY MARTY SNYDERMAN



Left: A school of convict tangs, Acanthurus triostegus, *browses on a rocky protrusion in the southern Sea of Cortez. Above: An assistant illuminates a mound of soft corals near Las Animas, rocky islets which feature cool water and excellent visibility.*

Should the opportunity arise for you to take a trip to the Sea of Cortez (read: Gulf of California for the less romantic), jump on it!

My chance came with a call from an old friend, Dan Gotshall, marine biologist and underwater photographer.

The plan called for departure from La Paz, Mexico on a Saturday in mid-October and spending six days aboard the dive vessel *Baja Explorador.*

I liked the choice of time and place. October is a good month for Baja California waters. Surface temperatures should range in the low 80s — quite a bit warmer than the familiar kelp beds off San Diego. The water in the southern reaches of the Sea of Cortez is usually clear, relatively current-free and heavily populated by a variety of marine life.

The group that gathered in Los Angeles to begin the journey was predictably mixed: a plumbing contractor, a swimming instructor, half a dozen biologists, a physician, a professional

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Carl Sisskind is a former broadcast newsman for ***Time/Life*** *and a regular contributor to* ***Sport Diver.***

continued

photographer, a nurse, a computer programmer, a construction worker and a retired dive shop owner. The diversity of occupation provided a fertile reservoir from which grew a smooth and pleasant camaraderie.

From Los Angeles, it's a two and a half hour flight to La Paz via Aeromexico. The clear day gave us an excellent overview of the area we'd be diving, stirring a subtle excitement before we'd even left the beach. The expected lag in Mexican customs was no better or worse than usual, and within two hours of landing, we were on our way to the bay.

The *Baja Explorador* has a matronly grace, reminiscent of the 1920s. In fact, she played a major role in the movie *Lucky Lady*, whose story was set in that period. Ted Waltham, the *Explorador*'s owner/skipper, had a bit part as a gangster. It's not hard to get Waltham to talk about the experience either.

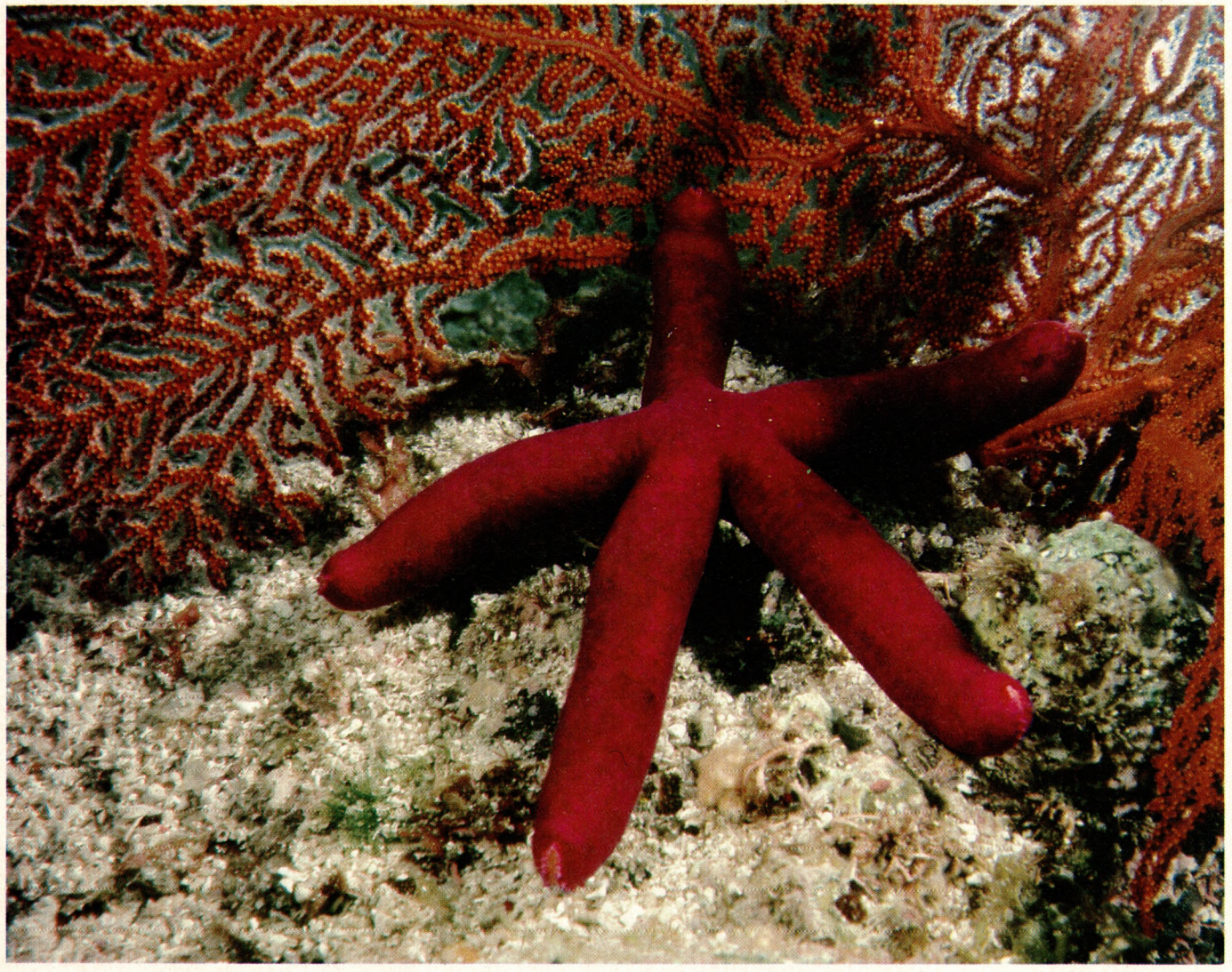
The *Explorador* is most comfortable. She sleeps 22 in nine cabins along her 120-foot length. A beam of 30 feet and displacement of 300 tons makes her a steady ship even in a strong sea.

Our dives would be made from the four skiffs—two 18-footers and two 14-footers. The boatmen don't leave the boats when their charges are in the water. They stay at the tiller, motor ticking over, following the bubbles. With something bordering on euphoria, I realize that on not one of the 20 dives we made did I have to move more than ten feet to reach the skiff after surfacing.

After a comfortable overnight cruise out of the bay and an early breakfast, a line was made fast from the ship to part of the sunken *Mazatlan*, a ferryboat. The first dive was typical, with the water at 83 degrees and 80-foot visibility. The wreckage lies in two major chunks in 70 feet of water, and over the years has become an active habitat. Parrotfish, crevalle jack and triggerfish are common. A lone golden grouper provided unusual subject matter for the photographers.

The second dive was made at Serano Rock, in the same area. An abundance of sea lions augmented the now-familiar fish population, their nonchalant attitude permitting some close-up photographs, and, for the uninitiated, a dash of excitement.

During lunch, the ship moved along the west face of Ceralbo to another rock, this one called Seronita. It's a small reef whose pinnacle barely breaks the surface about 100 yards offshore. Again, the same fish in the same clear, warm water, although this time the convoluted reef served as a more impressive background for the array of marine species.



Opposite: A fuchsia starfish, family Linckiidae, closes in to feed on a large gorgonia near Isla San Jose. Left: Brain-like basket star, Gorgonocephalus eucnemis, *with its hundreds of branchlets retracted, is surrounded by a deep-water gorgonian, which flourish because of the swift currents in the Sea of Cortez. Below: Guineafowl puffer,* Arothron meleagris, *stops for a sea urchin lunch.*

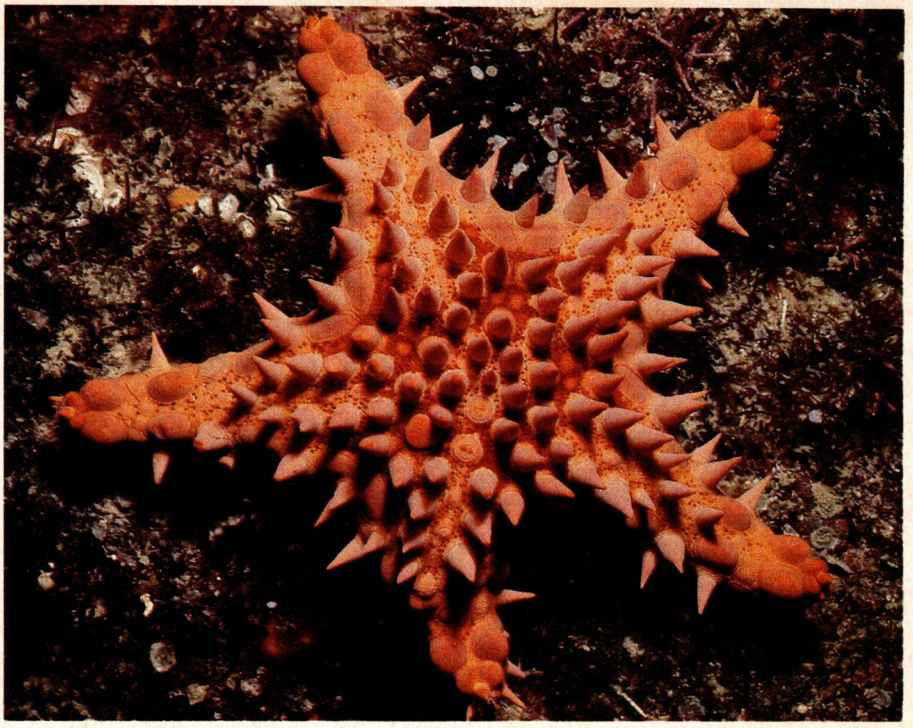
continued

After four daylight dives at Roca Mantagne the next day, our group made its first night dive. Cyalume lights were issued to each buddy pair. These were taped to the snorkels, providing a pinpoint beacon, easily visible underwater. On the surface, they can be seen for at least a mile. As a way to keep buddies together and as an aid to the pick-up boats, they are unbeatable.

The bottom was strewn with snake-like cucumbers, while the unusual zebra morays could be found in the rocky crevices. Needlefish were common; not so common was the sighting of a diamondback sea turtle. The phosphorescent streaks in the clear water marking the movements of divers and the beams of hand-held lights gave the seascape an ethereal, surrealistic aura.

An overnight run brought us to Los Frailes, a point on the eastern rump of Baja's southern extremity. The latter part of the trip, during the sunwashed early morning hours, provided a kaleidoscopic view of the rugged Mexican shoreline. We anchored in 40 feet of water on a bright yellow sand bottom. Less than 200 yards away was a curving beach backed by jungle-like scrub.

Off the point, our dives were shallow. The bottom was thickly cobbled with rock, cut by broad sand channels. The larger boulders had come from slumping of the limestone point jutting from the land above. Some new species appeared: puffer, golden sea chub, Mexican goatfish, Pacific boxfish, coronet fish and even a spotted eagle ray.



Below: Off Callo Reef, this parrotfish was found sleeping with its head in the corals at 15 feet. Right: San Diego Reef is the home of this spiny sea star, some of which are fish-eaters.

Angling off towards the beach, we found a canyon which emerged close to shore. The south wall descends gently from a sloping sand seafloor, but the north wall is an abrupt vertical face studded with sandstone boulders. Within 25 yards, the depth dropped from 65 to 135 feet, the bottom of the gorge narrowing until it stretched barely ten feet between the walls. At 110 feet, a thermocline layer dropped 16 degrees in less than ten feet.

Surge, a three-knot current and wind limited us to a single dive at Cabo Pulmo coral reef the next morning. The bottom was a shallow 20 feet which amplified the surge and forced us to cling to the coral. The area is commonplace, the fish without special significance and the reef moderately interesting. When a decision was made to return to Los Frailes, no one complained. That night we made the long haul north to La Paz, and by morning were anchored several miles off the peninsula which guards the entrance to La Paz Bay.

The order of the day was diving on the wreck of the *Salvaterra*, an old LST-cum-ferryboat which sank sometime in the last decade with a load of trucks. The bottom registers 60 feet, while the upper part of the rusting hulk is only 35 feet below the surface.

The wreck is an aquarium gone wild. Clouds of Cortez grunt and goatfish drape the vessel. At one time we were among a school of barracuda which easily numbered several thousand. None of the animals showed any apprehension as we closed; they were so docile we had to push them aside, like parting a heavy, breathing curtain.

After two exciting dives, we made for La Paz, dropping anchor in early afternoon, freeing the evening for exploring the town.

The Baja Peninsula is twice as long as Florida. It drops from the Mexican border with California like a strong, slim root seeking succor in the Pacific Ocean—750 miles of arid territory separating the Pacific on the west from the Sea of Cortez, and facing the rest of Mexico like an opposable thumb. Until 1973, when the Mexican government opened the Transpeninsular Highway, its special beauty was a challenge overcome by only the more hardy four-wheel drivers and light plane pilots.

Capital of Baja Sur, the newest Mexican state, La Paz has a population of barely 65,000. It is situated around a deep inlet off the larger bay. Arranged along a series of low hills overlooking the bay, La Paz is protected from the open water of the sea by a long sand bar.

For over 400 years, black and pink pearls were drawn from the Sea, the most extraordinary of which form part of various European crown jewels. But pearls aren't found very frequently these days, and La Paz currently derives its income from sport fishing (its waters are world-famous) and other kinds of tourism. There is some minor industry on the outskirts of town.

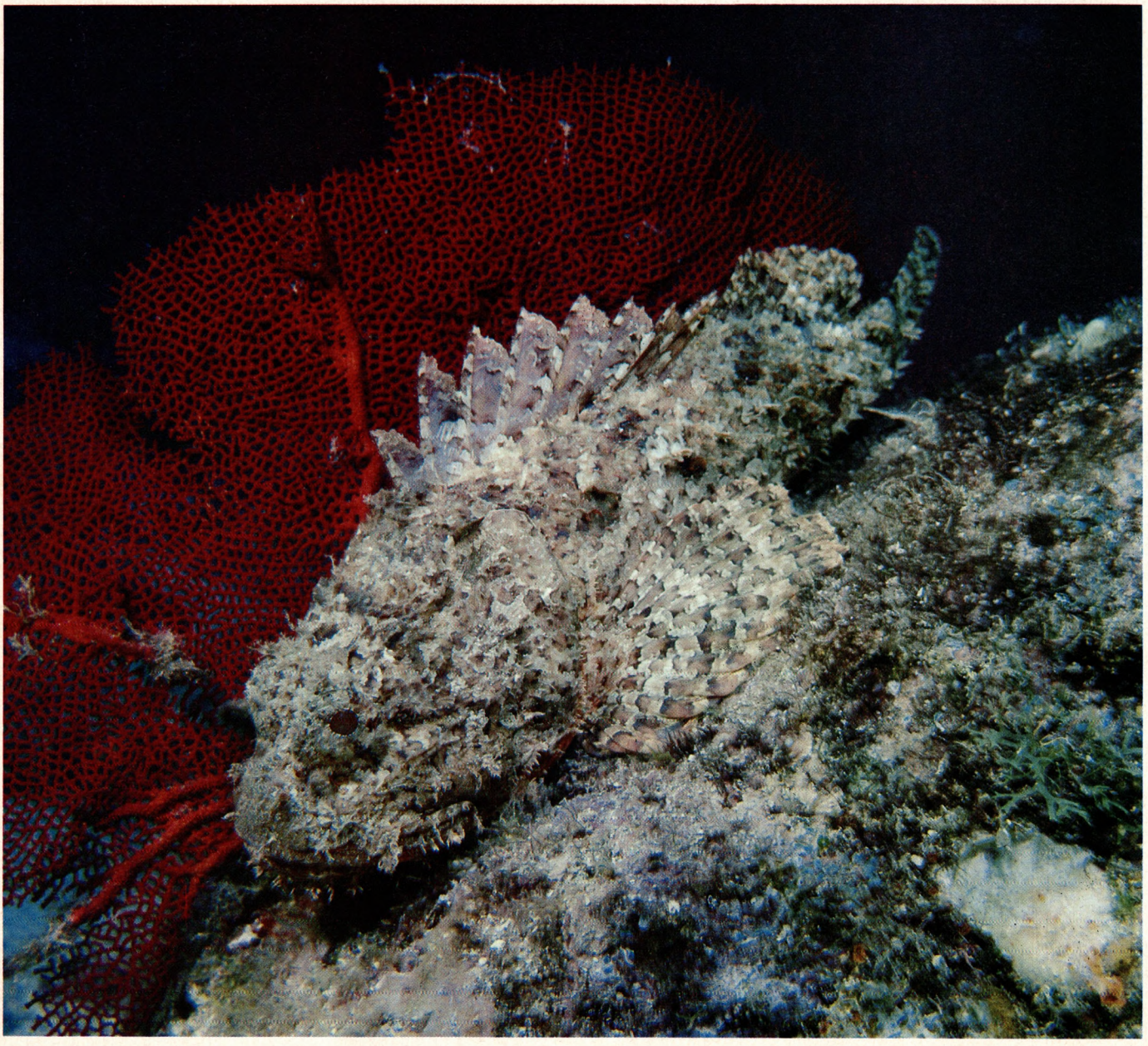
Hérnán Cortés landed in La Paz in

continued

1535 and named it Bahía de la Santa Cruz (Bay of the Holy Cross). The area was inhabited by the Guaicuru Indians, who were friendly to the white invaders. Apparently their hospitality encouraged another Spaniard, Sebastian Vizcaino, to change the name to La Paz (peace) when he arrived in 1596. Other Spanish expeditions, including pearl hunters, came and went. It wasn't until the Jesuits came in 1720 and founded the mission Nuestra Senora de La Paz, that the town began to develop. The cathedral built by the Jesuits in 1861 is still in use today, and is worth visiting.

Another, if more mundane, attraction is shopping. Imports and local goods are advertised at free port rates, and the prices are not bad. They're not super cheap either. There is a comfortable variety of restaurants, but check the window menus before you enter because prices vary from really cheap to stupendous. For the non-adventurous, the dining room at the Los Arcos Hotel should satisfy. You may want to remove your watch while in La Paz—wherever you eat, the pace is likely to be leisurely, so sit back and dine quietly.

After a good night's rest in the hotel, we loaded up in the cabs and headed for Aeromexico at the airport. This is the sort of trip you're not likely to forget, or stop planning to do again.



DANIEL GOTSHALL

Master of disguises is the stone scorpionfish, Scorpaeno mystes, *who blends in with the scenery instead of fleeing from its enemies.*

SPORT DIVER DESTINATION DATA

SEA OF CORTEZ

GENERAL
Location: La Paz: 720 miles southeast of San Diego and 260 miles northwest of Mazatlan, Mexico
Topography: a hilly mountainous peninsula with rocky coastline, seaside cliffs
Climate: subtropical with 4 inches of annual precipitation
Population: 62,000
Largest towns: capital: La Paz (pop.) 50,000
Languages: Spanish, English
Ethnic composition: 61% Indian/Spanish, 30% Indian, 9% other
Economy: mainly a resort economy
Monetary unit: Mexican peso = $.04
Diving season: Oct.-March
Tourist season: Oct.-March

DIVING
Water temperature: winter 65-75, summer 76-86°F
Visibility: 70-80 feet, rainy season June-Sept.
Depth of dives: 20-130 feet
Types of diving: reef, wreck, night, spearfishing
Skill level: intermediate
Sights:
Fish: golden sea chub, Mexican goatfish, barracuda, Cortez grunt, yellowtail, amberjack, striped marlin, golden grouper, triggerfish, red snapper, parrotfish, angelfish
Coral: black-coral forest, octocoral sea fans
Shells: rock scallops, pinshell clams, pearl oysters, murex, conch
Other: sea lions, diamondback sea turtles, spotted eagle rays, wrecks of the *Mazatlan* & *Salvaterra,* lobster, porpoises
Restrictions: Existing Mexican fish & game regulations

DIVING SERVICES
Instruction available: resort course
Equipment rental: mask, fins, snorkel, weight belt, weight, tank, backpack, regulator, depth gauge
Equipment sales: All the above except: BC, BC with inflator, decompression meter, full wetsuit, partial wetsuit, knife, game bag, dive light, Nikonos, camera housing, underwater strobe
Equipment repair: minimal
Camera repair: none
Air: yes
Guides: yes

DIVERSIONS
Ground transportation: bus, taxi, rental car, bicycle, auto ferries from Guaymas, Mazatlan & Topolobampo
Shopping: fair and expensive
Restaurants: fair and expensive, average meal $10
Nightlife: hotel restaurants, discos, lounges, Mariachi bands
Other sports: hiking, deep-sea fishing, hunting, water skiing, tennis, boating, canoeing, sailing, horseback riding
Don't Miss: Jesuit cathedral built in 1861; natural rock formation, Los Arcos at Cabo San Lucas.

SEA OF CORTEZ

JUST IN CASE...
Hospitals: Hospital General, Bravo y Lic. Verdad, ph: 2-1594, 2-1593; Hospital Regional Militar, Revolucion 794, Norte, ph: 2-3488
Recompression facilities: Contact hospital, ph: 2-1594, 2-1593
Police: Dial operator
Marine Rescue: ph: 2-1100
American Express: Convisa S.A., 16 de Sept 730, Local B-1, Guadalajara, Mexico, ph: 1-21991
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Pilots info: La Paz Airport, La Paz; Cabo San Lucas Airport, Cabo San Lucas
Gas: yes
Lighted runway: yes
Repairs: yes
Aeronautical Chart: CH-22 & CJ-24

Nautical Chart: 621

Hotels with packages: Hotel de Los Arcos, Box 112, La Paz, ph: 2-2744; Hotel Hacienda, Cabo San Lucas, write: Hotel Hacienda, Box 48872, Los Angeles, CA 90048, 800-421-0645; Hotel Serenidad, Box 9, Mulege, BC Sur, ph: Mulege 11; Punta Pescadero, Baja Sur, East Cape, write: Box 1044, Los Altos, CA 94022, (415) 948-5505
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Customs and Immigration: Requirements: tourist card and proof of US citizenship
Import restrictions: None affecting normal tourists; quarantine imposed on pets

How much cash may you bring into the country? $5000
Export restrictions: normal for Mexico
How much native currency may you take out of the country? no limit
U.S. Customs re-entry restrictions: articles not exceeding total of $100, once in a 31-day period
Bibliography: *Diving Mexico's Baja California,* Michael & Lauren Farley, Marcor Enterprises, Port Hueneme, CA; 1978, 175 pgs; *Reef Fishes of the Sea of Cortez,* Donald Thomson, Lloyd Findley, Alex Kerstitch, John Wiley & Sons, NY, 1976, 302 pgs.; *1980 Pacific Boating Almanac: South California, Arizona & Baja,* Western Marine Enterprises, Ventura, CA, 1980, 400 pgs.

Product Survey:

Voice Communicators

"Say what?" becomes "You can say that again," as divers stop gesticulating and start communicating using new voice technology.

BY LOU FEAD
PHOTOGRAPHY BY JOHN LIDINGTON

Underwater communicators pass the words in simple to complex fashion. Sea Sonic's Sea Voice, left, operates like an underwater megaphone, amplifying and projecting the human voice. Helle Engineering's Hellephone, above, and the Sport-Phone by Sound-Wave Systems, following page, use an ultrasonic frequency to transmit messages.

Some divers wave hand signals, some tug on buddy lines, others bang furiously on their tanks. The patient ones scribble on plastic slates, if their pencils aren't broken. Regardless of technique, they're all trying to exchange information under water — information that could be better transmitted by the spoken word.

But speaking under water isn't so easy. In fact, it's usually hopeless. Talking under water barely works at all, just about like walking there. But, as fin makers have developed equipment to overcome the water's resistance to walking, so have others come up with marketable solutions to the talking problem. The solutions are the objects of this survey.

The first and simplest is the Sea Voice, a mechanical device to help get the spoken word out into the water where it can be heard by all who listen. Following the lead of divers who've shouted through their regulators, gloves, masks and fin pockets for years, Rosalyn International, as Sea Sonics

continued

Sport diving instructor and consultant, writer, author of ***Easy Diver*** *and fun-diver extraordinaire, Lou Fead is a regular contributor to* ***Sport Diver.***

Inc., developed an inflatable sound box to be easier to use and much more efficient than its predecessors.

Starting with a rubber mouthpiece, molded to fit snugly around a diver's mouth, the Sea Voice consists of a hard plastic cone section, a flexible rubber bladder, a lanyard and a wide rubber band holding it all together. That retails for $24.95.

The cone section acts as a small megaphone to concentrate and direct the spoken energy into the narrow sector of the bladder rather than letting it disperse randomly in the water. The bladder, constructed of a specially compounded rubber seventeen-thousanths of an inch thick, allows sound energy to pass through it reportedly without distortion or volume loss. The cone and bladder work together to increase the amount of sound energy entering the water from the diver's voice. The bladder also traps the diver's bubbles so they don't break up the words.

To talk to another diver the sender takes a breath, spits out his regulator, presses the Sea Voice to his pursed lips, stretches the uninflated bladder out front and speaks four to six words into the mouthpiece. He then retrieves that air from the bladder and uses it again to say another four to six words. Rosalyn International recommends messages be limited to 15 seconds and that the bladder air not be rebreathed — a reasonable precaution since the possibility of building carbon dioxide up to excessive levels in the bladder does exist.

To listen to Sea Voice the receiver needs no special equipment — his own ears are enough. But he can reduce interference with the message at his end by equalizing his ears to hear better and by not breathing during the message.

Communication ranges of 30 to 40 feet have been obtained by divers who've practiced with Sea Voice. Though the elementary construction makes it seem simple, several hours of training are absolutely necessary for learning the techniques for maximizing the intelligibility of its messages. The listener has to train too.

Similar requirements apply to the more sophisticated equipment made by Helle Engineering, Inc., and Sound-Wave Systems. Though their electronic approach to voice transmission underwater involves an ultrasonic frequency to carry the words from diver to diver while Sea Voice uses human audio, many of the same impediments to transmission exist. The nasal voice quality caused by a scuba mask, the physical restriction of speaking into a mouthpiece, the interference of environmental, biological and man-made sound absorbers, reflectors, scatterers and noise sources all make training necessary so the equipment can be operated to offset uncontrollable effects.

Helle Engineering says that practice with its unit, the Hellephone, will improve communications rapidly. The unit, Model 3117, consists of a full-face mask with microphone installed, a bone conductor earphone and an electronics

cylinder with attaching straps for $595. Each diver wanting to communicate must have a Model 3117, while topside use is via the $525 Model 3118.

The Hellephone full face mask has two compartments: one essentially an oval purge-valve mask sealing around the diver's eyes and nose; the other for his mouth and microphone, plus inlet ports for either a single- or double-hose regulator without a mouthpiece. The mask is equipped with a "spider" strap to hold it snugly in place. The microphone has a "push to talk" switch fitted on the right side for transmitting — it returns to listen automatically.

The earphone is a small round disc, about an inch and a half in diameter and a half-inch thick. Worn somewhere near the diver's ear, but definitely not sealing the external canal, it's held in place by the mask straps or hood.

The annodized aluminum electronics cylinder — containing the transmit and receive circuitry, eight penlight batteries for power, and the ultrasonic transducer — weighs about five pounds and is two and a half inches in diameter and 15 and a quarter inches long. Double O-ring sealed for easy battery access, the cylinder can be quickly piggy-backed on any scuba tank with its two D-ring closed nylon straps.

Capable of submerging to 300 feet, the Hellephone's half-watt of output power gives a half-mile of range in quiet open water and up to 300 feet in locations crowded with high background noise. The batteries will last about eight hours. The surface unit, Model 3118, has all the same electronics and performance characteristics but is not designed to be submerged.

For a Hellephone diver to transmit, he must submerge to automatically energize his unit, depress the "push to talk" switch, and speak clearly into the microphone. To receive, he simply releases the switch.

Unlike the Sea Voice, the air expelled by the Hellephone diver in speaking exhausts through the regulator as bubbles and degrades the ultrasonic signals somewhat. Breathing noises also partially mask the transmitted voice tones with the sound of rushing air. Both these effects can be reduced if the diver uses as little air as possible in making his words — pitching his voice higher is one way of doing that.

The listener can likewise help re-

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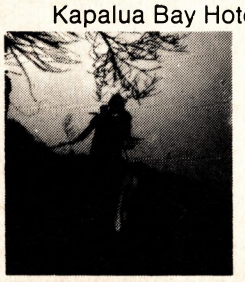

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ceive the message by not breathing during the transmission. And, if both divers are in sight of each other — not shielded from one another by any obstructions — the transmission doesn't have to snake around and perhaps get lost trying to find the receiver.

The same operational considerations apply to the communicators produced by Sound-Wave Systems. Though similar in concept to the Hellephone, they differ by using 31.5 kHz as the carrier frequency instead of Helle's 42 kHz, and are made in several different submersible models.

The simplest is the Sport-Phone, Model SP-01. It consists of a mouth-mask with microphone installed, a bone conduction earphone and an electronic pack for $197.50.

The mouth-mask, called Wet-Mask by Sound-Wave Systems, fits closely about a diver's mouth to make an air space for speaking. Cradling the chin, it's held in place by its own strap across the back of the diver's head, under the normal mask strap. Designed with an inlet port for a single-hose regulator, the Wet-Mask eliminates the jaw strain associated with clamping a regulator between clenched teeth. A full-face mask could be used in place of the Wet-Mask.

The bone conduction earphone, mounted in a rubber cushion for comfort, is one and three-quarters inches in diameter and a half-inch thick. Sound-Wave Systems suggests it be tried in different locations near each ear to find the optimum receiving spot.

Half the electronic pack includes the ultrasonic transducer and transceiver potted together. The other half, the battery compartment holding eight penlight batteries, is O-ring sealed to it. Clamped together, the two-pound pack is seven inches tall by four and a quarter inches wide by two and one-eighth inches thick, small enough to be mounted in many places. Most commonly, it's put on a BC, arm, or elsewhere on the upper body, but not on a weight belt — if the belt were jettisoned, it would take the unit with it and yank the Wet-Mask off too.

The Sport-Phone can be operated down to 130 feet to give communications across approximately 100 yards for six hours. Another model, the Wet-Phone, extends those limits to 200 feet maximum depth, 400 yards range, with about seven hours of battery life. The

Buyer's Guide

Conquest Marketing Company, Inc.
(Sound-Wave Systems' exclusive distributor)
3176 Pullman St. Suite 110
Costa Mesa, CA 92626

Helle Engineering, Inc.
7198 Convoy Ct.
San Diego, CA 92111

Rosalyn International, Ltd.
P.O. 94458-A
Schaumburg, IL 60194

Wet-Phone is produced in two models, the WPI-01 for $294 and the WPV-02 for $377, neither includes the Wet-Mask, which sells for $32.50.

The Sport-Phone and both models of the Wet-Phone start listening automatically upon immersion. For transmitting, the diver wearing a Sport-Phone or WPI-01 Wet-Phone simply covers an exposed screwhead on the electronic pack and speaks into the microphone. The diver with a WPV-02 Wet-Phone, on the other hand, need only start speaking to turn his transmitter on; no screwheads to cover or switches to operate. The WPV-02 Wet-Phone is truly a no-hands device — labelled VOX by communications folks — quite convenient for the busy diver.

If the business happens to be professional, the diver can link his Wet-Phone acoustically with a Wet-Phone Surface Tender Unit for only $417. If it happens to be instructing, he can mate his unit with one or more Wet-Word units so his students can hear him without being able to talk back. A single Wet-Word costs $146, while three with a Wet-Phone and Wet-Mask become an Instructor Package selling at a bargain price of $726.

Whether instructor, professional, or sport, divers nowadays are all benefiting from the efforts of manufacturers like Sound-Wave Systems, Helle Engineering Inc., and Rosalyn International Ltd. who've made it possible to talk underwater without doffing gloves or shucking fins. And, according to the scuttlebutt from hidden drawing boards, the 1980s promise to bring even more intelligent, and maybe intellectual, conversation to the silent world.

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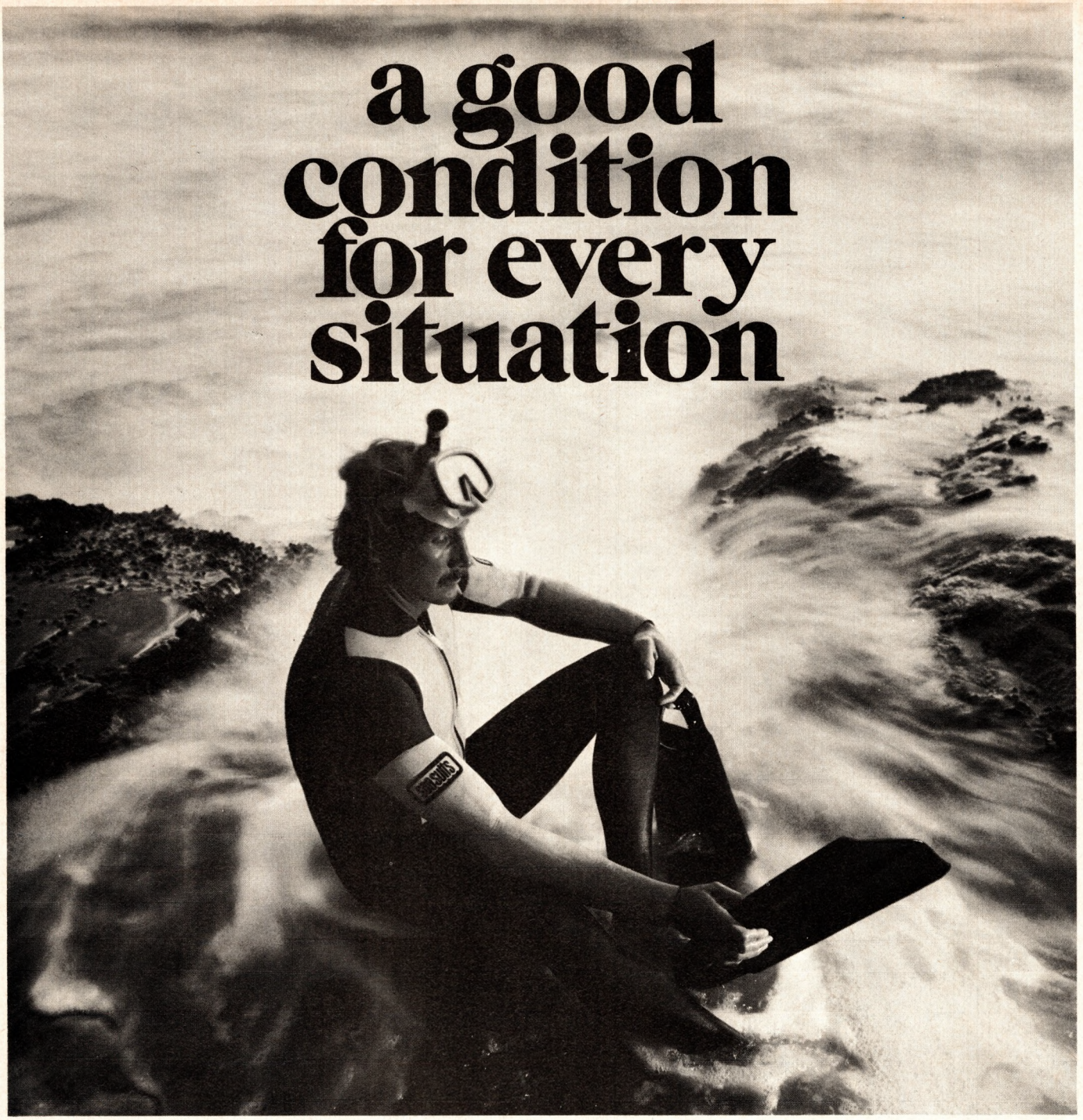

Let's face it, diving is a sport that takes place under a great variety of situations. There is no single wet suit to cover every possible dive situation. Choosing a wet suit that will prove satisfactory under the greatest variety of conditions isn't easy - there are a lot of wet suits out there to choose from. ☐ But there is a wet suit manufacturer who makes a wet suit for every dive situation and that's Sea Suits. Sea Suits makes a full line of dive suits. A dive suit for every condition plus one more. That extra condition is quality. Sea Suits emphasizes quality because quality is the one condition that covers every condition. Nothing serves as well as having the best. ☐ If you want the best no matter what the situation choose a Sea Suits. We know quality satisfies... it always has and no matter what the conditions it always will.

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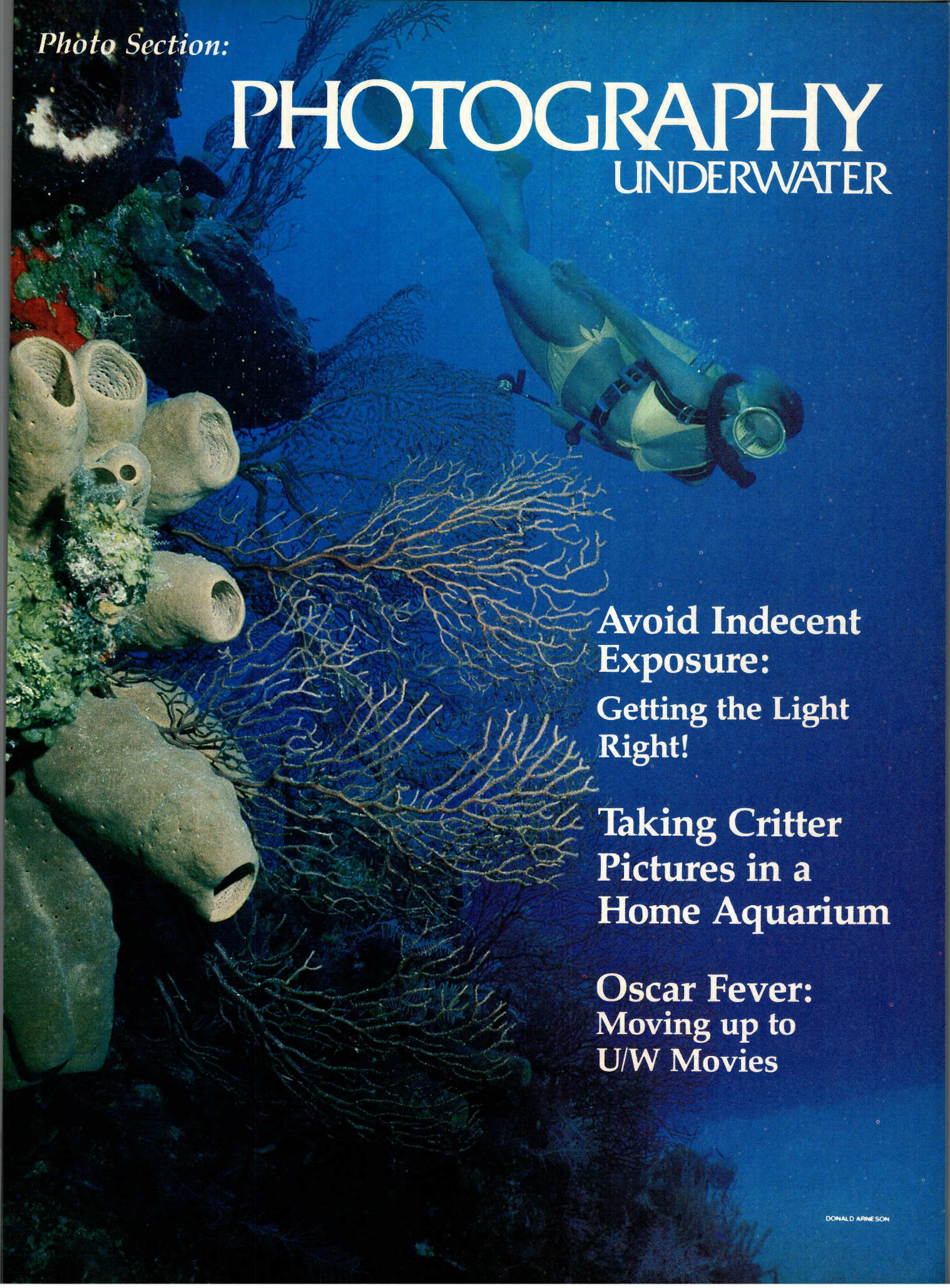

Avoid Indecent Exposure:
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Underwater Photography/First Exposure:

Avoiding Indecent Exposure

Now that you have a camera, you have to learn how to use those scales and dials to make a good photograph.

TEXT AND PHOTOGRAPHY
BY STEPHEN FRINK

The single most important factor affecting the technical excellence of a photograph is proper exposure. The composition may be genius, the lighting angle inspired and the subject thrilling, but if the film isn't exposed correctly the effect of these elements will be lost.

In making photographs, light reflected from a subject is focused by a lens onto a light-sensitive medium (film). The light causes changes in the film which are exaggerated and made permanent by chemicals (the developer); the result: a photographic image.

The amount of chemical change in the film, and the lightness or darkness of the resulting image, is directly proportional to the amount of light allowed to strike the film.

The tricky part is to manipulate the amount of light reflected from the subject (by adding light from a flashbulb or strobe, by moving into shallower water or by photographing during the brightest part of the day) and the amount of light falling on the film (by adjusting the lens aperture — or f-stop — or the shutter speed, which governs the time the film is exposed to the light). Using the camera controls and the available light creatively, you can record an image which is lighter, darker or the same brightness as the original subject.

The Controls

From here on, we'll assume your camera has provisions to manually control the lens opening and shutter speed. Exposure techniques for cameras without these controls are covered on page 89 .

The lens opening is controlled by a diaphragm, calibrated in f-stops. The scale for these runs "backwards," that is, the smaller the f-number, the larger the

---

Stephen Frink operates a custom film processing/camera rental facility in Key Largo, Florida.

Both of these tricky exposure situations were solved using the "smallest f-stop" rule. The photo (facing page) looking up, if exposed to give correct skin tones in the diver, would have shown the surface greatly overexposed. By choosing the smallest f-stop, then filling in the diver with a strobe, the vast difference in exposure is reconciled. At left, the strobe exposure of the diver was a stop too small to render the background water as medium blue. Using the small f-stop and letting the water go dark resulted in a more dramatic shot.

lens opening. At f-11, the lens opening is larger than at f-16. Reducing the size of the opening one f-stop (changing the setting from f-11 to f-16) will reduce the light reaching the film by 50 percent.

The shutter speed dial is calibrated in the same way. Increasing the shutter speed from 1/125th to 1/250th will cut the light reaching the film by 50 percent.

Film Speed

Films vary in their sensitivity to light. The more sensitive the film, the greater the amount of chemical change produced by each unit of light. In photographer's slang, the more sensitive a film is, the "faster" it is—a reference to the fact that, under identical light conditions, a more sensitive film allows the use of a faster shutter speed than would a film of lower sensitivity.

In order to make precise exposure estimation possible, the United States of American Standards Institute (formerly American Standards Association or ASA) has given specific ASA speed numbers to all films based on their sensitivity. The higher the ASA number, the more sensitive the film. The scale used relates to the scales for f-stops and shutter speeds: ASA 200 film requires only half as much light as ASA 100 film to produce an image of equal brightness.

Measuring the Light

Before deciding how much light to let into the camera, you must know how much light is available. The only way to accurately measure it is with a light meter. The meter is an electromechanical computer which, when programmed with the ASA of the film in use and pointed at a subject, will determine the "correct" exposure and indicate the appropriate shutter speeds and f-stops.

So far, correct exposure sounds simple. Go out and buy a meter, point it at the subject and use the indicated f-stop and shutter speed to record an image. We should be so lucky.

Using a Meter

Unlike the computers that fly airplanes and play chess, a light meter is not "intelligent." It doesn't know if the object you're pointing it at is pure white, dead black or something in between. What it does is measure the amount of light reflected from the subject and give an exposure which will reproduce the subject as a medium gray, halfway between pure black and pure white. Average Caucasian skin reflects 36 percent of the light that falls on it. The meter is keyed to this skin value. No matter how light or how dark an object it is pointed at, it reads an exposure that will render that object the same brightness as skin.

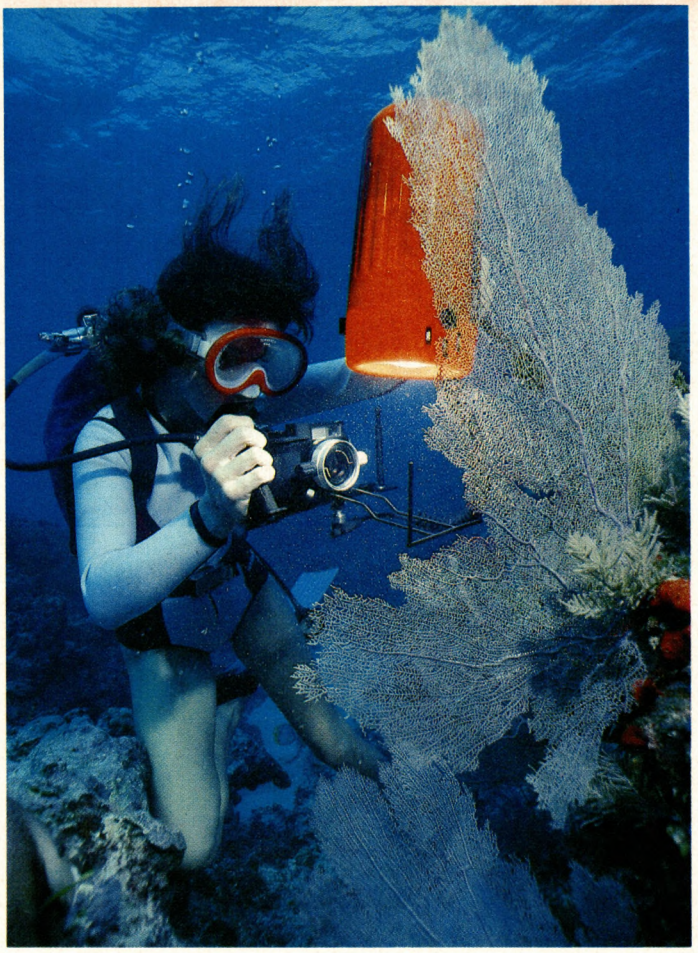
To properly interpret the meter reading you must take into account this bias towards reproducing skin tone. If you are pointing the meter at a dark object—darker than the back of your hand—the actual exposure to reproduce the object as being darker than your hand will be less than the meter indicates: You will need to use a smaller lens aperture or a higher shutter speed. If the object is very light—lighter than the back of your hand—you will need more exposure, and should open up the lens or use a slower shutter speed.

The meter is also not very selective about what it reads when you point it. Its angle of view is approximately 30 degrees. Everything within a 30 degree vector in front of the meter's sensing cell will be averaged into the reading. Many things underwater are sort of an average gray—blue tropical water between 20 and 50 feet deep, sea fans, many fish. But problems arise when you try to read a sea fan on a white sand bottom. The white sand reflects a great deal more light than the sea fan, causing the meter to indicate an exposure which will render the white sand as average gray and the sea fan much darker. To solve this, get as close as possible to your subject, point the meter directly at an area of average reflectance and take care not to cast a shadow on the area being read.

De-Bugging

If you are using a meter, are convinced you're using it correctly and keep getting film that is consistently under- or over-exposed (too dark or too light), you can vary the ASA film speed setting to compensate. If you are using ASA 64 film, for instance, and your photographs are consistently too dark, try setting the ASA at 50 (about one-half of an f-stop lighter). If they are still too dark, decrease the ASA setting until you are pleased with the results. If your film is too light, try setting the meter at 100, and

continued



When using strobe, the light can be moved farther away from the subject to bring the strobe exposure into a better balance with the exposure for the background. Compared to the photo of the diver overleaf, this shot looks more "natural."

increasing that setting until you get the right results.

Since meters are electro-mechanical devices they are subject to going out of calibration. If your meter uses batteries, be sure they are providing the proper voltage. Some meters have a "zero set" adjustment which allows you to null the needle at zero should the scale shift.

If you suspect a problem with your meter, check it against a meter you know is working. Another rule of thumb is to take it outside on a bright day. The back of your hand when pointed towards the sun should read approximately f-16 at 1/ASA second. With Ektachrome 64 or Kodachrome 64, the meter should read f-16 at 1/60th of a second; for Kodacolor 100, f-16 at 1/125th; for Ektachrome or Kodacolor 400, f-16 at 1/500th.

Estimating

If you still aren't convinced you need a meter or don't want to make the investment, there is a rule of thumb. Underwater, light is lost at about one f-stop for every ten feet of reasonably clear water. Using the estimates for topside exposure — f-16 at 1/ASA second — we can assume f-11 at ten feet, f-8 at 20 feet and f-5.6 at 30 feet. These will only be valid between the hours of ten a.m. and two p.m. when the sun is out full with good vertical penetration and the seas fairly calm. If the sky is overcast, or if the sun is low in the sky, or if the waves reflect a significant amount of light back up, or if you're working on the shaded side of a reef, a variation of one to three f-stops over these estimates is not uncommon. Even for someone with considerable experience judging light levels underwater, the meter is an important tool.

Artificial Light

To add sparkle and highlights to your underwater photographs you need to introduce some artificial light from a flashbulb or strobe. This will, of course, complicate matters.

If your camera has a focal plane shutter (such as the Nikonos and 95 percent of the 35mm cameras made today) you will be restricted to using a shutter speed of either 1/60th or 1/125th of a second with a strobe unit. This is the shutter speed at which the shutter is wide open when the strobe goes off, assuring even edge-to-edge exposure. If you are using a strobe and notice dense black bars across one end or edge of your photographs, you're using the wrong shutter speed or the synchronizing mechanism is defective. Consult your camera's manual for the proper speed.

If your camera has a leaf shutter (the Canon G-III 35mm and most 2¼ x 2¼ cameras do), or you're using flashbulbs, you have the option of shutter speeds up to 1/500th. To make the calculations easier, it's best to standardize on one shutter speed, such as 1/60th, until you've mastered the basic technique.

Testing the Strobe

First, determine the proper exposure for the strobe alone, exclusive of sunlight. This can be done by photographing a stationary object of average reflectance—such as green brain coral—at night. When you do this, hold the strobe exactly three feet from the subject. Shoot one exposure at each f-stop—from minimum to maximum—and record the frame numbers and the corresponding f-stops next to each other on a slate.

When you get the photographs developed, choose the one with the most pleasing exposure, determine its frame number, and look up the f-stop it was exposed at. This is your basic exposure. Typically, for a unit such as the Oceanic 2003, Subsea Mark 150, Sea&Sea YS-150 or the new Ikelite Substrobe 150, the proper exposure with ASA 64 film will be f-8 at three feet. There are wide variations in power output from strobe to strobe, and similar variations in your camera, so you must make this test using your own equipment. If using a strobe, be sure to let it fully recycle before each exposure. Wait several seconds after the ready light appears before shooting. It is also advisable to make this test using a transparency film—Kodachrome, Ektachrome or Fujichrome. If you use a print film, the person who prints it has a good deal of leeway in correcting poor exposures. The result may be that you receive your test roll back with four or more different prints that look "correct."

If you use a transparency film for the test but normally shoot print film, choose a transparency film with approximately the same ASA as your print film. For ASA 100 print films, Ektachrome 64 or Fuji R-100 would be a good choice. If you use the ASA 64 film, remember your print film is half again as

Exposure for the Uncontrollable Camera

If your camera has no aperture or shutter speed control — such as the pocket camera or simple 35mm — you'll have to settle for less than ideal exposure under all conditions.

Generally, if your pictures have been coming back too dark, use a film with a higher ASA—such as Kodacolor 400. If they've been too light, use a film with a lower ASA, Kodachrome or Ektachrome 64 or Kodacolor II (ASA 100).

Another solution is to add a flash unit. Ikelite markets a cube flash for $24.95 that will mate to all of its housings with SST triggers or to a Nikonos with the Ikelite SST pack.

If you know how deep you will be diving, it is possible to choose the best possible film before you get in the water. Generally, pocket cameras without electronic exposure control have a fixed aperture—f-11—and a fixed shutter speed—1/90th of a second. This should be just jim-dandy with Kodacolor 100 film in ten feet of water. But go down to 20 feet and your photographs are going to be a little dark.

The following table should give relatively acceptable results:

---

10 feet: Use Kodacolor II (ASA 100)
20 feet: Use Kodacolor II film and insert the base of a used flash cube into the camera's flash socket to slow the shutter down (and give you more light).
30 feet: Use Kodacolor 400, no flash cube base in the socket.
40 feet: Use Kodacolor 400 and insert the flash cube base.
Below 40 feet, you'll need some sort of flash to get consistent results.

If you don't want to bother carrying several kinds of film, try using only the Kodacolor 400 and buy +1, +2 and +3 neutral density filters. Insert the used flash cube base into the camera flash socket before the dive and carry along the filters. At 40 feet or below, use no filter. At 30 feet, use the +1 filter; at 20 feet, the +2 filter; and at 10 feet, the +3 filter.

Meter Ratings

There are several meters designed exclusively for use underwater. The Sekoniç L-164 Marine Meter is the tried-and-true standby. It retails for $149.95. Dacor markets this meter under it's own brand name as the DLM and sells it for $165.

The popular and inexpensive Sekonic L-86 is a small hand-held meter which is sold with an O-ring sealed case.

Farallon/Oceanic introduced their OM-100 meter in 1979. Like the Sekonic and Dacor, it is a single-unit submersible meter designed for underwater use. It lists for $94.50.

Leach Photo Systems markets a meter made by Sea&Sea called the Sea Meter which lists for $104.50.

Of these meters, only the Sekonic L-164 and the Dacor DLM are CdS resistance meters; the others are non-battery powered photo-electric cell meters. The CdS resistance meter will be more sensitive to extremely low light levels and does not hold a "memory" of bright subjects as the photo-electrics do. Just as you see spots in front of your eyes after looking up at the sun, the photo-electrics tend to "see" or read bright spots after being pointed at a light source.

Ikelite markets Lexan housings for topside meters including the venerable Gossen Luna Pro, which has a well-deserved reputation for durability and accuracy. Stock housings are also available for the Gossen Super Pilot, the Weston XM-1, XM-2, Master V and Master VI. Custom installations are available from Ikelite.

Dacor Corporation
161 Northfield Rd.
Northfield, IL 60093

Farallon/Oceanic
1333 Old County Rd.
Belmont, CA 94002

Ikelite Underwater Systems
P.O. Box 88100
Indianapolis, IN 46208

Leach Photo Systems
P.O. Box 75
Keno, OR 97627

Sekonic
Copal Corporation of America
58-25 Queens Blvd
Woodside, NY 11377

sensitive to light. If you determine the proper exposure for ASA 64 to be f-8 at three feet, set the aperture control between f-8 and f-11 for your first roll of print film. Ektachrome 400 and Kodacolor 400 have approximately the same sensitivity to light, and no adjustments should be necessary.

Light Fall-Off

You now know the proper exposure using your strobe at a distance of three feet. To get the same results at other distances, you'll have to change the aperture. The intensity of light decreases about one f-stop for every one foot increase in distance. If f-8 is correct at three feet, then f-5.6 is correct at four feet, f-4 at five feet and f-2.8 at six feet. Light intensity increases one f-stop for every one foot decrease in distance. At two feet, the proper exposure would be f-11, at one foot, f-16.

Strobe Plus Sunlight

Once you know the proper strobe exposure, it's possible to integrate strobe exposures and natural light to achieve a particular effect. To reproduce a scene more or less as you see it, read the reflected sunlight with your meter. Set the f-stop suggested by the meter and then move the strobe to the distance that will produce a correct exposure at that aperture. Let's assume your strobe is similar to the one mentioned above. Your meter reads a coral head as requiring f-8 at 1/60th, and the water behind it reads the same. Position the strobe three feet from the coral and expose. The result should be a bright coral backed up by medium-blue water. If the meter suggests f-5.6 you would position the strobe four feet from the coral, and so on.

Now assume you're in 30 feet of water with ASA 64 film and the meter suggests f-5.6. You're trying for a fish portrait, and at the close distance required to make the fish big enough in the frame, you can only hold the strobe three feet from the fish. If you set f-5.6 and expose with the strobe at three feet, the fish will be over-exposed. Too much light will reach the film and your subject will be "burned out." An alternative is to set the aperture at f-8, which makes the strobe the dominant light source,

continued

and allows the background to go dark. This may even help separate the fish from its surroundings and produce a better photograph.

Now assume you're in very shallow water and your meter suggests f-16 for the fish shot. Exposing at f-8 for the strobe will result in over-exposure—this time from the overabundant sunlight. You have two options. One is to move the strobe closer, to within one foot of the fish, and expose at f-16. The other is to leave the strobe where it is and expose at f-16. Either way, you'll get a properly exposed photograph. If you move the strobe closer, it will be more nearly equal to the sunlight in value and the natural colors will show more clearly. If you leave it at three feet, it will function as a fill light, opening up the shadows and supplying a few highlights.

In either situation, deeper or shallower, by comparing the aperture required for strobe exposure to that for sunlight and always using the smaller of the two, you'll avoid the gross errors that can result in indecent exposure.

Underwater Photography/With the Pros:

Aquarium Photography

There's another way to round out your underwater portfolio, and it's easier than shooting fish in a barrel.

BY DICK JACOBY

One nice thing about taking pictures of fish in an aquarium is that you don't have to hold your breath and then worry about drifting up. The fish is in its medium and you are in yours. In fact, by shooting fish in an aquarium, you'll be able to exercise control over your environment and the fishes', you can wait for the fish to pose, the fish will be less leery of you and you won't run out of air or get knocked around by the surge. The result can be some well-composed, well-lit additions to your marine slide show.

The best results are obtained by using a single-lens-reflex camera and a moderate wide-angle to moderate telephoto lens.

First, you have to choose a method of lighting the tank: available light, strobe or photofloods.

Using available light means you'll have to use one of the ASA 400 films,

Dick Jacoby is a former TV photojournalist and author of two texts on underwater photography.

STEPHEN FRINK

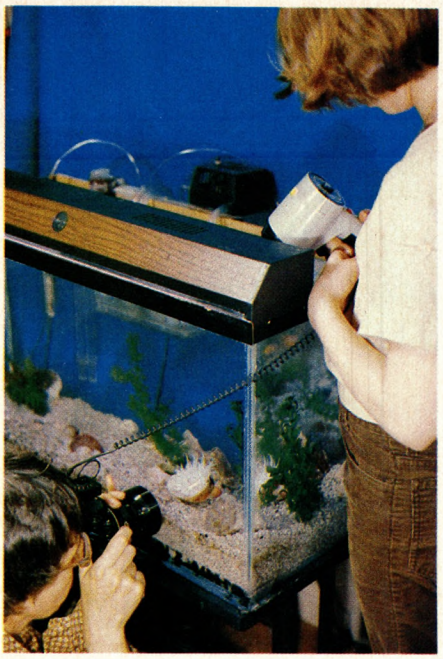
With the inclusion of a sea fan or other appropriate background, your aquarium photographs can have an authentic open-water look.

shoot at 1/60th and probably live with shallow depth of field. One possibility is to shoot invertebrates or other sessile subjects. Then you can use a tripod, set the shutter speed low and hope the Siamese Fighting Fish don't swim through the middle of an exposure.

Use your camera's meter to determine exposure, but be aware that particulate matter suspended in the water will give a false reading. You may need to increase exposure up to one full stop over the meter's suggestion; the amount of increase needed varies with tank size and the amount of suspended matter.

Photofloods can be used successfully and two 500-watt bulbs should give 1/125th of a second in a small to medium aquarium with ASA 320 film. Use Kodak Ektachrome Tungsten film (ASA 160) and special processing to obtain the ASA 320 rating, or use daylight ASA 400 film and a color-correcting filter.

There are two types of photofloods: you want the ones that produce light at 3200° Kelvin. Place them so no reflections are visible on the aquarium glass when viewed through the camera. About 45 degrees off the lens axis is usually right. It's also a good idea to use a matte box in front of the lens to hide reflections of the camera body. You can make an acceptable substitute by cutting a hole in the bottom of a Kodak Carousel slide tray box (the bottom half) to poke the lens and lens hood through.



Directing the strobe down into the tank from the top will help to minimize backscatter, particularly if the tank water has suspended matter in it.

An electronic strobe is the most convenient light source. Ideally, use a strobe with a beam angle wide enough to cover the area of a 28mm lens.

For broad, flat lighting, hold the flash in front of the aquarium, near the camera and at right angles to the glass. For more sculptured lighting, hold the strobe over the top of the aquarium. When lighting from the top it may be useful to place a piece of black cardboard over the front surface of the aquarium at the top to prevent the strobe's light from shining directly into the camera lens.

You'll have to determine your own exposures based on tests, but my strobe, tested to have a guide number of 68 with ASA 64 film, gives good results when the lens is set at f-5.6 or f-8. I use 5.6 for multi-colored tropicals and shift to f-8 for silvery fish.

Clear aquarium water is a good indication that the aquatic environment is healthy. Clear water also makes it easier to shoot pictures. Just as in the ocean, suspended particles in turbid water will reflect light back into the lens as backscatter. The solution is the same too — move the strobe farther off the lens axis, causing the reflections to bounce back toward the strobe instead of the lens.

The water in home aquariums is usually light blue, blue-green or heavily green. The latter hues relate to decreased visibility and increased turbidity. Regardless of color, the water will act as a filter to remove some colors from the light reaching the film. Just as underwater, green restrains the color magenta, an important component of red. No amount of filtration will replace the lost magenta, but the right magenta filter over the lens will remove an amount of green equal to the amount of magenta

Gearing Up

The rules are simple. Use a single-lens-reflex camera, if possible, with a lens of 28mm to 90mm (for 35mm). Use a lens hood. Hold the camera at or very near the glass when using flash or available light. If you use photofloods, get the lens as close as possible to the tank without blocking light from the bulbs.

Be sure to hold the camera so the lens axis intersects the plane of the front of the aquarium at a 90-degree angle. The interface between the glass and the air creates a lens that will distort photographs taken from any other angle. You can avoid scratching the glass by using a soft rubber lens hood or cushioning a metal lens hood with your hand.

Find a comfortable place in front of the aquarium. Because you can't angle the camera in relation to the aquarium, you may need to move around as the fish move. Better yet, find an attractive background, like an anemone, and wait for a fish to enter the frame.

Getting the Right Filter

Filters are available in a great range of density values. The more pronounced the color of the water, the greater the filter density needed to correct it.

Purchase a set of color compensating filters (CC filters) and a filter holder for your camera. The CC filters are optically pure gelatin, so be easy with them; they are very sensitive to rough handling and especially to moisture.

Find your correct exposure, then make a series of exposures of subjects by changing the filters to increasing densities. It is best to use only one filter per exposure.

Density values of five, ten, 15, 20 and 40 are commonly used. If you are using magenta filters, the designations will be CC5M CC10M and so on. You need to increase your exposures as the filter density increases.

Evaluate the filtered slides by projecting them side-by-side with an unfiltered slide of the same subject. If you are using print film, place the filtered prints beside an unfiltered one. Your comparison will be dramatic and final selection should be easy.

You may need to do some fine tuning with a second filter test. If, for example, photographs taken with the CC10M and CC20M filters are both close but not quite it, retest with a CC15M. When you have determined the best filtration for your aquarium, buy an equivalent glass filter and use it in front of your lens.

continued

lost in the water, thereby restoring the color balance.

Use of complimentary filters can control the other water colors as well. Use a slight red filter if the water is equally blue and green, or a yellow filter if the water is deep blue.

Getting the animals to pose is always a problem. If you're photographing a public aquarium, there's nothing to do but wait. If you're at home, have an assistant move the fish around with an aquarium-cleaning sponge on a stick. Or move the fish towards the front of the aquarium by blocking off a portion of the tank with an aquarium background.

In either situation, patience is your prime directive. It takes time and a certain amount of experimentation to get the right combination of exposure, lighting and composition. But when you get it right, you'll have a fool-proof system for nailing those elusive sea-life portraits without getting wet.

Underwater Photography/Means and Methods:

Making Movies

For those willing to make the jump, motion adds a dramatic new dimension to underwater photography.

BY BOB WALLACE

Few media can capture the human experience with the immediacy of film. When Thomas Edison married photography to the zoetrope (a Victorian parlor toy that used sequential drawings inside a spinning wheel to simulate motion) he created what some critics maintain is the dominant art form of this century.

Since Jacques Cousteau produced *Silent World* in the early 1950s, thousands of miles of movie film have been exposed by divers using scuba.

Even though underwater cinematography has remained something of a closet addiction, a wide range of excellent tools are available to the budding enthusiast. Cameras and housings in Super-8mm, 16mm and even 35mm formats can meet any conceivable need. For high rollers, there are even sophisticated underwater video systems debuting in the marketplace.

For all but the most discriminating (and wealthy) or the professional, Super-8 is the best bet. A pro-quality Super-8 camera costs less than one-third what a minimal 16mm camera costs. The

*Bob Wallace's work has appeared in **National Geographic**, **Sea Frontiers** and the **Saturday Evening Post**. He is a regular contributor to **Sport Diver**.*

GALE LIVERS

A Super-8, housing and lights could bring out your hidden talents. Who knows? You could be the Cecil B. DeMille of the silent world.

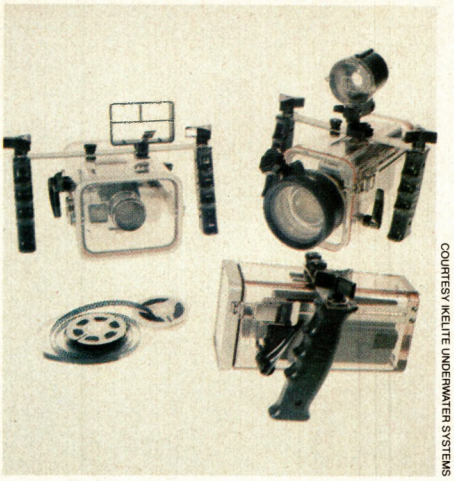
housings cost less too. And to expose and develop Super-8 film costs about $4 per minute compared to $12.50 per minute for 16mm. If you must have 16mm, a competent professional lab can print Super-8 film up to 16mm with fairly good results, and Super-8 can be converted to video tape very successfully.

In still photography scenes are made one by one; the images are unconnected in time and have no spatial context. Motion pictures, to be effective, must *move*. They must depict action, the action must flow forward in time, and there should be some element of continuity to carry the viewer forward from scene to scene. A common error lies in not recognizing the essential differences between still and motion pictures. The still photographer may lie in one place and wait for something to happen in front of the camera. The cinematographer must seek out the action and portray it in a way that makes it understandable to the viewer. Each sequence in a film should be at least 12 seconds long—even if it's a static shot of an anemone. This gives the viewer time to recognize the object and examine it. While filming, count off the seconds and don't stop before you reach 12. A master scene, that is one that depicts action important to the viewer's comprehension of the film's narrative line, should run three to four minutes or longer. Some sort of connective device should be used between scenes. If one master scene shows divers looking under a ledge and the next shows them on the other side of the reef feeding fish, you might film a pair of angelfish swimming from the ledge area up and over the reef to the other side to provide continuity.

"Dolly" shots can be effective underwater. Hold the camera in front of you and attain a smooth forward motion using your fins, then start shooting. Moving along the bottom gives an interesting effect as colors are revealed by the movie lights. I once followed a large stingray for several yards using this technique, keeping just behind its tail. When projected, it was very dramatic. When following an animal this way, remember to leave time at the end of the sequence for it to swim out of frame.

For variety, follow a diver who is using a movie light. As they move the light over the scenery, the color will direct the viewer's eye where you want it.

Lighting is the single most important factor in obtaining good footage.



COURTESY IKELITE UNDERWATER SYSTEMS

Lexan housings, such as these by Ikelite, are available for a wide variety of Super-8 and 16mm cameras. Metal housings and housings for 35mm and video cameras are also available.

A constant, uniform light source is essential. Two movie lights of at least 100 watts each provide good illumination. One of the lights should be significantly closer to the subject than the other. The closer light will function as a key light or main illumination. The other will fill in dark shadows on the opposite side while leaving some shadow to provide modeling of the subject.

Unlike still photography, the lights should be attached to the camera housing so that the focus of illumination moves smoothly with the camera.

Underwater flares can provide unusual lighting effects. They tend to produce hot spots and should be kept at least several feet from the camera. The flares expel some solid matter into the water, and can decrease visibility in enclosed areas.

One common mistake is to leave the lens cap on when using an attached viewfinder system. Make a habit of looking at the lens port each time you submerge. You'll be able to see if the lens cap is on. Also, bubbles may form on the housing port; these can be removed by rubbing your fingers over the surface.

Be prepared to deal with a flooded housing. Most housing leaks occur around ports or external controls as result of an improper seal. When changing film, an O-ring can slip out of place. Check all O-rings and locking latches before getting in the water.

Some housings are equipped with a valve so the unit can be pressurized. If there is a leak, air bubbles may be seen escaping from the housing. Pressure can implode a housing, too. If this happens you will hear a loud pop. When making a decompression dive with a camera, it's a good idea to have a small CO_2-inflated lift bag along. If the housing begins to leak, you can send the unit topside to a surface diver who can remove the camera and minimize water damage.

After every use, and before sealing the camera for the next dive, carefully check all O-rings for sand or other debris. In shallow water a small particle could cause a bad seal and leakage. If the camera housing has not been depth tested recently it is advisable to take it down without the camera to test it.

If you store your housing and camera in an air-conditioned environment, it may fog when exposed to warm, moist air. After a few minutes underwater the lens should clear itself.

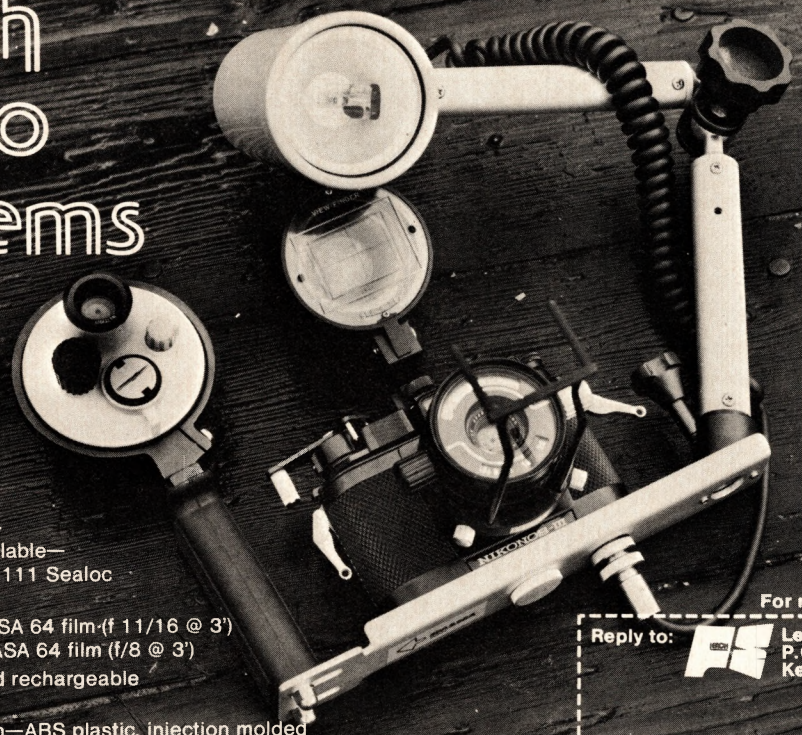
The rising popularity of underwater films may prompt you to consider your work for commercial use. The 16mm format is an ideal medium for television productions. Rentals of 16mm, and the more expensive 35mm equipment, are available through professional equipment rental companies such as Image Devices in Miami, Florida. For more remote on-location work in the Caribbean, underwater cinematographer Gerry Hytha's new Cayman Diving Lodge on Grand Cayman Island can supply everything from Super-8mm to video equipment. Rush processing of 8mm, 16mm and 35mm film is available, or the more impatient can rent a completely self-contained half-inch video camera and VTR system housed. For commercial use I prefer a housed 16mm or 35mm Arriflex camera.

Last year, Eumig introduced its Nautica Super-8, a true amphibious cine camera — sort of a Nikonos for the home-movie crowd. A modified version of the Nautica that runs at 24 frames per second to allow sound synchronization is available from Helix of Chicago.

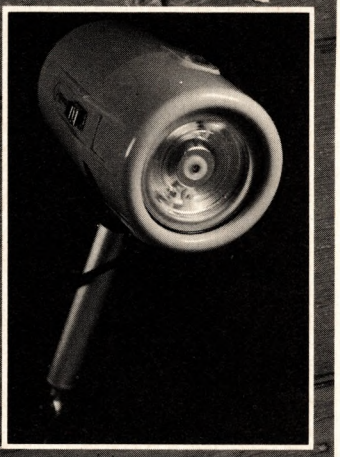
Farallon/Oceanic and Ikelite offer modular movie light systems for use in film productions.

Remember, it is easy to become so involved in filmmaking that the dive plan is ignored. Keep a close watch on your depth and remaining air supply, or your film career may be no more than a short subject.

Leach Photo Systems



YS 150 STROBE



YS 150 STROBE

F (11-16)

Slave is available at ½ end full power.
Charge Time—12 hrs.
Sync connectors available—Nikonos 11, Nikonos 111 Sealoc
GUIDE NUMBER
(Fullpower) 25 with ASA 64 film (f 11/16 @ 3')
(half power) 24 with ASA 64 film (f/8 @ 3')
Power Source—Nicad rechargeable 7.2 volts
Material/Construction—ABS plastic, injection molded
Mounting system—male thread mounted on strobe
Flashes per charge—100 full power, 200 half power
Recycle time—full power 3 sec/half power under 2 sec.

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For more information:

Reply to: Leach Photo Systems
P.O. Box 75, SPD
Keno, Oregon 97627

☐ Please send catalog (Enclose $1.00)

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THE CAMERA SETTING CALCULATOR

All The Essential Adjustments & Information To Improve Your U/W Photography!

Developed by the author of UNDERWATER PHOTOGRAPHY NOW, P. J. Diamondis (to be published later this year). This unique calculator combines proven exposure tables and other data in a convenient form, allowing you to optimize your settings for the BEST COLOR PHOTOS TECHNICALLY POSSIBLE.

- **Aperture setting (f-number)**
- **Flash guide number**
- **Film speed (ASA)**
- **Flash bulb type**
- **Object distance**
- **Shutter speed**
- **Number/type-filter**
- **Best camera-light position**
- **Additional hints & suggestions**

6-in diameter disks made of waterproof non-corroding materials with eyelet for attachment to equipment.

Calculator may be purchased for $10 from P.J. Diamondis at 255 Redwood Road, Merritt Island, FL 32952

CAYMAN DIVING LODGE— EAST END, GRAND CAYMAN ISLAND

East End, Grand Cayman, B.W.I.

RESERVATIONS: Call or write Airtour Universal Inc., 241 E. Commercial Blvd., Ft. Lauderdale, FL 33334. (305) 491-0333, FL toll free: (800) 432-8894. Nationwide: (800) 327-8223. All U.S.

LOCATION—Lodge is located on southeast end of island, directly on the waterfront and beach. 18 miles from airport in center of East End.

TRANSPORTATION—Air: Cayman Airways, LACSA from Miami, Republic from Miami, Ft. Lauderdale and Houston. Ground: courtesy car pickup for groups, car rentals in town.

ACCOMMODATIONS—18 air-conditioned rooms. Restaurant and bar on premises. Continual sea breeze, porches overlook ocean. Windsurfing, fishing, waterskiing, snorkeling. Rates from $45 pppd (summer). 10% service charge, 5% government tax, major credit cards accepted.

DIVING AVAILABLE—

Shallow reef **yes**	Walls **yes**	Drift dives **no**
Mid reef **yes**	Wrecks **yes**	Night dives **yes**
Deep reef **yes**	Caverns **yes**	Beach dives **no**

DIVING EQUIPMENT—2 Mako, 1 Bauer Compressor, 3000 PSI. 50 72 cu/ft, 50 80 cu/ft aluminum. 3 boats, 36' for 15 divers, 26' for 12 and 24' for 10. Guaranteed daily diving. Full service retail store with rentals.

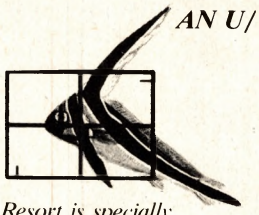
DIVING SERVICES—All major certifications. 2 instructors/2 divemasters and chamber operator, CPR first aid trained. Resort course $50. Full certification $200. Cost half day diving (2 tanks) $22.50, full day (3 tanks) $40, night dive $27.50 (with light). Basic gear included in rate.

DIVING PACKAGES—7 nights from $315 per week. Includes accommodations (d/o). 2 meals/day, free courtesy airport transfer, 2 tank dive daily and basic gear.

U/W PHOTOGRAPHY—Complete *U/W* photography and movie courses by professionals available on a regular basis. Write in advance as classes are limited to 10. *Complete U/W photo rentals with cameras, lenses and all accessories.*

CAYMAN DIVING LODGE

East End Grand Cayman, B.W.I.



Resort is specially designed for divers by divers.

AN U/W PHOTOGRAPHER'S RESORT

Lodge has been specially redesigned to handle all U/W Photography needs from 35mm, 16mm to Video Tape. Courses are taught by professionals on a regular basis.

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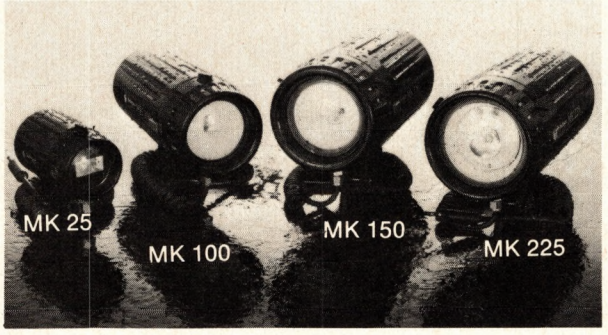
SUBSEA

The No. 1 Choice of Professional Underwater Photographers



MARK 25
Energy rating 18 w/s
Power Source 3 "C" cell batteries
Beam Angle 60°
Recycle Time 5.5 seconds
No. of flash 450-1000

MARK 100
Energy rating 50 w/s
Power Source 300 v Eveready #493
Beam Angle 90°
Recycle Time 3 sec./6 sec.
No. of flash 150-750 (full)

MARK 150
Energy rating 50/100/150 w/s
Power Source 510 v Eveready #497
Beam Angle 90°-150° variable
Recycle Time 1 sec/2 sec/3 sec 1/4/6
Integral Slaveyes
No. of flash 500 (full); 750 (150) 1500 (50)

MARK 225
Energy rating 75/150/225/ w/s
Power Source Nicad batteries
Beam Angle 110°
Recycle Time 2 sec./8 sec./6.5 sec.
No. of flash 100/200/300

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(305) 844-8937; (TWX) 510-952-7672

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Professional U/W Photo Instruction

INSTRUCTOR: Stephen Frink is an excellent photographer with extensive experience in commercial photography and photographic instruction. Among his many accomplishments are numerous published photographs and articles on techniques of underwater photography which may be seen in SPORT DIVER Magazine.

LOCATION: The seminar will be held in Key Largo; the largest of the Florida Keys. The water is temperate and visibility is usually 50-80'. **Pennekamp Coral Reef State Park** boasts 100 square miles of protected reef system that abounds in corals and beautiful tropical marine life. The park will serve as the classroom for all open water dives.

COURSE: The course will consist of 3 days of intensive classroom instruction combined with actual U/W photography accomplished on six dives. Classroom presentations will include equipment familiarization, exposure determination, principles of effective fish photography, working with models, techniques of Macro Photography, creative strobe photography and use of wide angle lenses. Dive assignments will emphasize procedures taught in classroom sessions. Size of classes are limited to six to insure personal and individualized instruction. Overnight development of film will permit next day critique of previous days work. Course will cover use of both Nikonos system and housed SLR systems.

DATES: Aug. 5, 6, 7; 19, 20, 21. Sept. 16, 17, 18

PACKAGE: $300 per person. Includes 3 days professional individualized instruction, boat transportation (provided by OCEAN DIVERS), complete line of photo accessories for free use during course, overnight processing with next day critique, daily classroom and open water instruction. Required camera equipment is an underwater camera or SLR and housing, an U/W strobe or flash. Additional equipment may be rented upon request. For complete details, course syllabus and space reservation, write to address below:

PHOTO: JOE CLARK

"I'm very serious about my underwater photography, and I realize that if a person cares enough to enroll in a photo seminar, they are very serious. They deserve the opportunity to learn and be treated well."

STEPHEN FRINK PHOTOGRAPHIC
P.O. Box 1907/Key Largo, FL 33037
(305) 451-3737
Located in Ocean Divers — MM 102.5

Stephen Frink Photographic
Key Largo, Fla.

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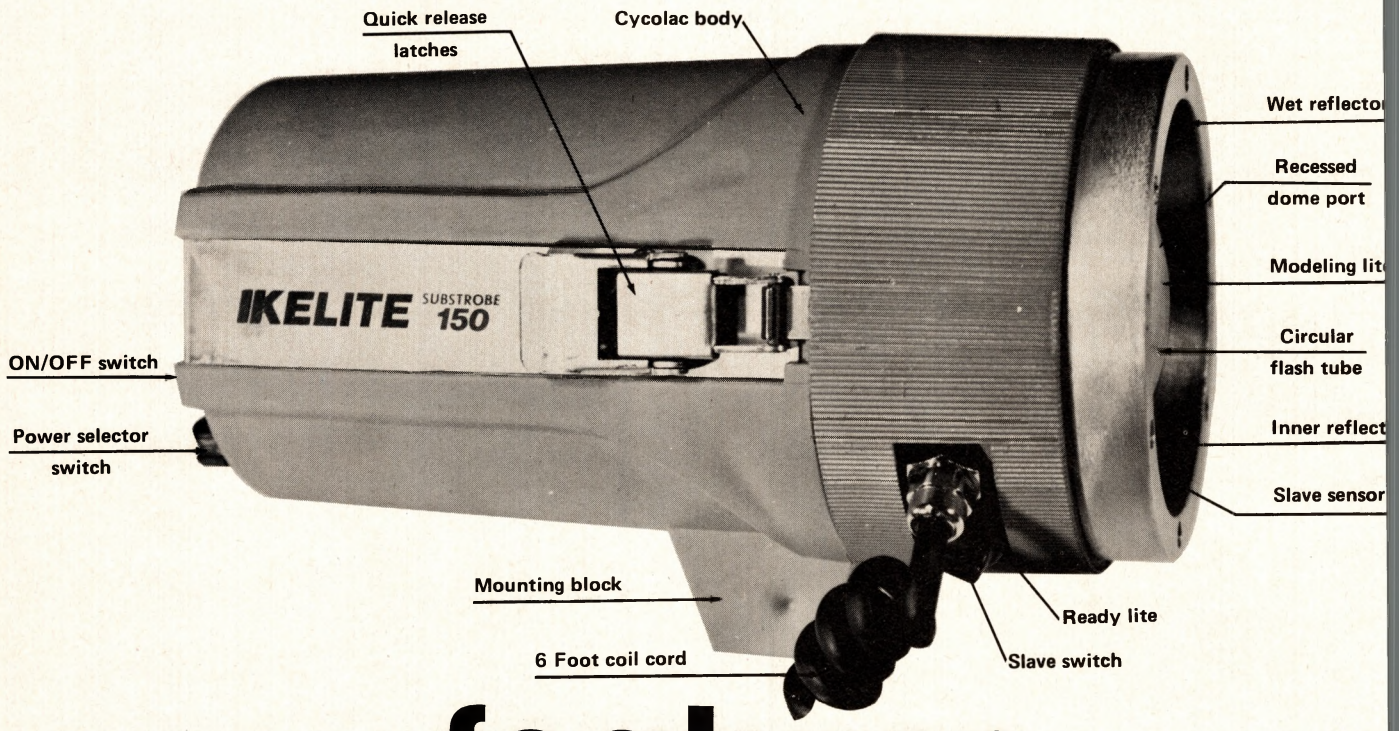
VERY FLASHY



features

SUBSTROBE 150

ENERGY RATING
Adjustable power output of 40 watt-sec., 75 watt-sec., 150 watt-sec.

POWER SOURCE
Interchangeable NI-CAD battery pack; standard recharge 15 hrs. Optional Quick Charger recharges in 3 hrs.

NUMBER OF FLASHES

@ 40 watt-sec.	approx. 600
@ 75 watt-sec.	approx. 300
@ 150 watt-sec.	approx. 150

RECYCLE TIMES

@ 40 watt-sec.	1.5 sec.
@ 75 watt-sec.	3.0 sec.
@ 150 watt-sec.	5.0 sec.

ANGLE OF COVERAGE
90 degrees

MODELING LITE
15 degree beam angle, 60,000 candle-power

MOUNTING BLOCK
Universally adaptable

CONNECTORS
Ikelite ICS or optional E/O

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ikelite
UNDERWATER SYSTEMS
3303 North Illinois Street
Indianapolis, Indiana 46208

SUBSTROBE 75

ENERGY RATING
Adjustable power output of 40 watt-sec., 75 watt-sec.

POWER SOURCE
Non-removable NI-CAD battery pack; standard recharge 4 hrs.

NUMBER OF FLASHES / RECYCLE TIME

@ 40 watt-sec.	approx. 300/1.5 sec.
@ 75 watt-sec.	approx. 150/3.0 sec.

Other features of the Substrobe 75 are the same as the Substrobe 150.

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America's Underwater Parks

One hundred years after creation of the first national park, park planners are finally considering underwater sites important enough to protect.

DANIEL GOTSHALL

Two mature rosy rockfish, Sebastolobus macrochir, *photographed off Pt. Reyes National Seashore north of San Francisco in about 90 feet of water.*

BY CARL SISSKIND

"An underwater park? Where is it, in downtown Atlantis?"

That kind of reaction has been painfully common during the more than ten years I have been involved with underwater parks. In its infancy during the 1960s, the concept of submerged parks was generally viewed as a little impractical, if not downright weird. But like most sound ideas, the time for this one has come.

Although the very first national parks in the U.S. were designated about 100 years ago, specific reference to marine and coastal systems was not included. Several national parks and monuments with coastal boundaries were established in the early 1900s (Olympic, 1909; Glacier Bay, 1910; Acadia, 1916; Katamai, 1918), but shoreline and marine resources, at least initially, were not a primary rationale for a park's existence. The first definitive

continued

Carl Sisskind is chairman of the Advisory Board on Underwater Parks for the State of California and a former broadcast newsman for ***Time/Life.***

RICHARD STEWART

Left: Brass plaques placed along the bottom in the shallow waters of Buck Island Park, U.S. Virgin Islands help snorkelers identify marine life. Right: Divers and porkfish, Anisotremus virginicus, *explore the wreck of the* Benwood *off Key Largo in Florida's Pennekamp Coral Reef State Park.*

acknowledgement of the importance of marine environments came in 1934 with the establishment of Everglades National Park in south Florida. The park today includes some 370,000 acres of productive marine waters and wetlands.

Later additions of marine, lake and coastal areas into the national park system reflect the growing realization that submerged lands and associated waters may have tremendous biological significance for contiguous parks. It is now obvious that there are vital reciprocal ties between aquatic systems and the terrestrial watersheds that nourish them. In setting park boundaries and management policies, these ties are now being recognized so that the continued health and integrity of existing parks can be assured. The total number of national parks with significant island, marine, lakeshore or seashore resources has now passed 30.

The essential purpose of any park, upland or underwater, is to preserve that small portion of the natural environment. But more than that, there is often a need to re-establish ecosystems in those areas of proposed parks where man's impact has seriously degraded nature's handiwork. So it was with Florida's John Pennekamp Coral Reef State Park and California's San Diego/La Jolla Underwater Park — both typical of the modern park from inception to daily operation.

Pennekamp, the oldest of this country's true underwater parks, had suffered most. Spoilers came and they plundered. By plane, boat, car or pogo stick they descended upon the Florida Keys and sacked one of our great national treasures — North America's only living coral reef.

Coral "collectors" attacked the beautiful formations with everything from crowbars to hydraulic hoists, yanking from their beds exquisite structures which had taken nature centuries to create. Soon chunks of coral, bleached to an unnatural white color, jammed the shelves of countless curio shops and private patios. Commercial shell collectors tore the reefs apart as they hunted rare specimens. Tropical fish habitats were looted for aquarium pets. Florida's conch populations were exhausted long before the thirst for them, so shells were imported from the Bahamas to satisfy the curio trade.

By 1957, concern for the situation coalesced at a biological conference held in the Everglades National Park. Dr. Gilbert Voss of the University of Miami proposed the reef be protected, if for no other reason than in the name of science. He was joined at once by Charles Brookfield of the National Audubon Society and Dan Beard, then superintendent of the Everglades park. On the spot, a motion was introduced requesting that the U.S. Department of the Interior and the National Park Service be petitioned to save the area.

Seldom has a rescue operation gained such momentum and met with so little bureaucratic resistance. Assisted by dedicated conservationists, some high-powered legislation and a presidential proclamation, a unique recreation area was finally created and the only undersea park in the United States became a reality on December 10, 1960. The park was dedicated to John Pennekamp, then the editor of the Miami *Herald*, who had played a major role in conservation causes and worked tirelessly in behalf of the underwater park.

Covering about 75 square miles of ocean waters, the park protects the northernmost portion of a chain of coral reefs that stretches 220 miles southwest to the Dry Tortugas. The actual park is 21 miles long by three-and-a-half miles wide. Only 55 freeway miles south of the Miami megalopolis, Pennekamp's coral forests and spectacular marine canyons are accessible from many points along the beach. The most popular access is park headquarters at Key Largo. Scuba diving and underwater photography are encouraged, but the removal or destruction of any marine life is prohibited. Spearfishing is taboo, yet some quirk in management thinking permits hook-and-line fishing. Anglers look for trout and bonefish in the flats, snapper and snook in the many creeks and grouper, snapper and mackerel on the reefs. Pleasant accommodations are available at the park's landside for camping and picnicking, while additional facilities exist for almost all marine services including boat rental.

For those who manage to resist the urge to plunge into the warm (70 to high 80s), blue-green waters, there is no need to miss the stunning beauty of Pennekamp's reefs. Glass-bottom tour boats offer visitors the option of one- or two-hour trips to inner and outer reefs.

Visibility is usually 60 feet, often better, and those who dive the park soon succumb to the peaceful attitudes of the fish — they are simply unafraid of divers. Some make a point of leaving their dens to greet bubble-blowing visitors. Tiny marine tropicals, dressed in their gaudiest array, have brazenly posed and preened within inches of my faceplate. Bigger folks like grouper, spadefish, snapper and parrotfish are almost as docile, moving slowly from my path rather than darting away as in other ocean areas. Each time I visit Pennekamp I can't help but think that this kind of rapport is the way it was intended to be.

A continent away lies the San Diego/La Jolla Underwater Park. In a community so closely oriented to the sea it is mildly surprising that some sort of ocean preservation program took so long to evolve here. What ultimately became the San Diego/La Jolla Park had its beginnings in casual conversations among members of the Bottom Scratchers — the first diving club in the U.S. — and a few diver/scientists at Scripps Institution of Oceanography in La Jolla. These otherwise sincere people, during the initial planning in the early 1960s, believed the creation of a park to be a simple matter: Just announce a plan, point a finger at

FRED BAVENDAM

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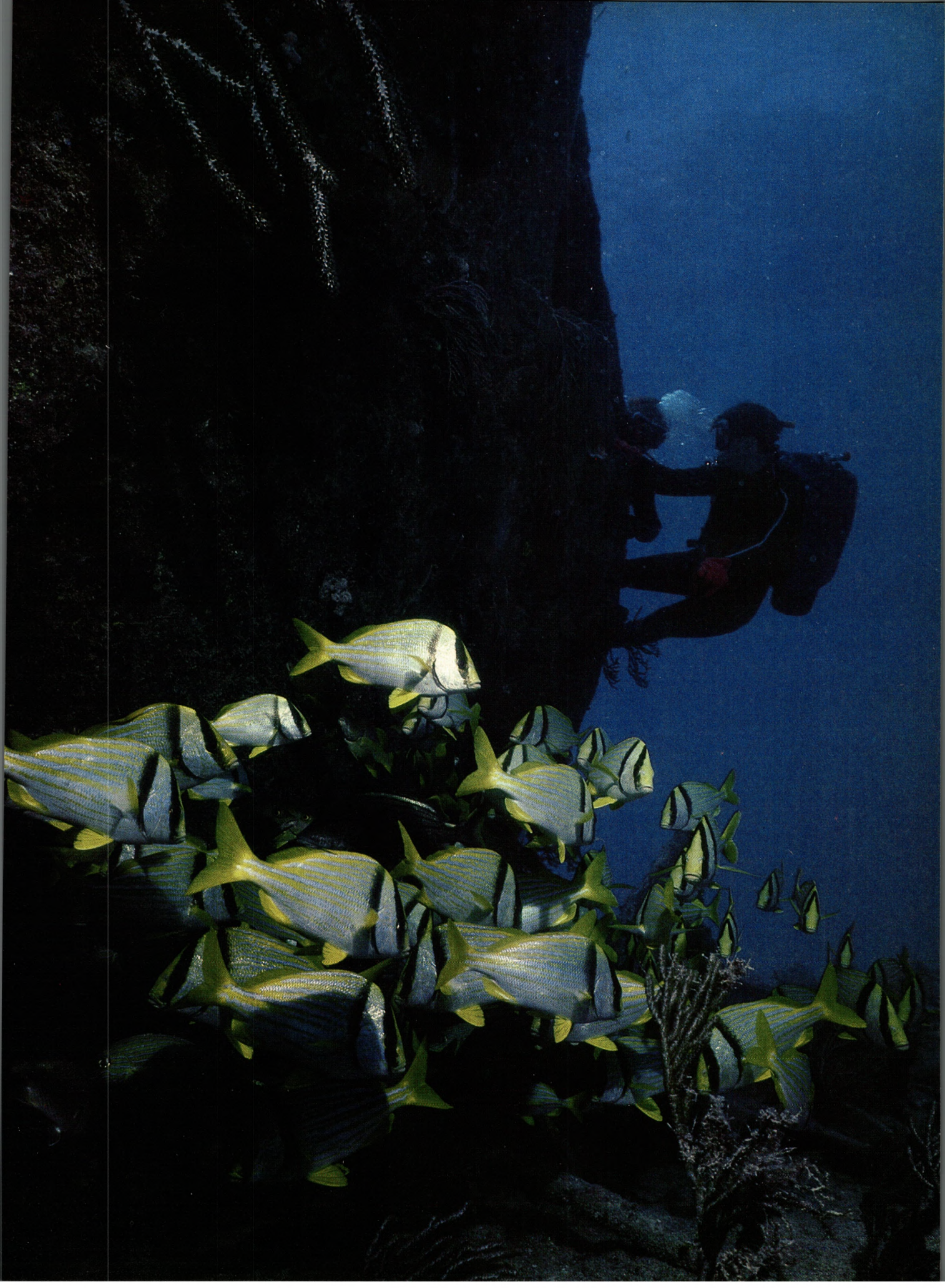

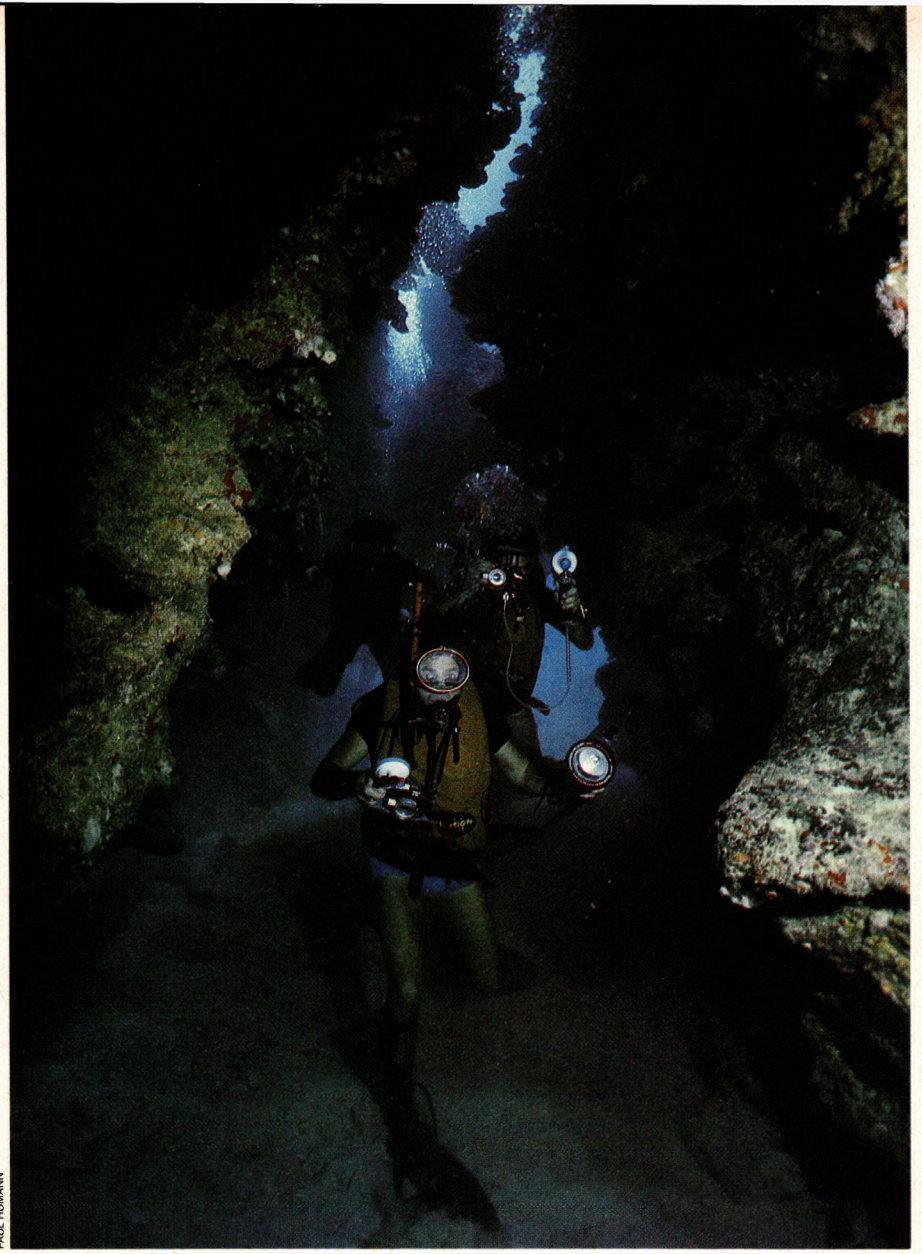

PAUL HUMANN

Shallow coral canyons of Mexico's recently designated Palancar National Park in Cozumel attract divers from all over the world.

the spot and the public should rally to the cause. This unfortunate error in judgment was not resolved for 12 years.

The early planners made the mistake of talking largely to each other rather than organizing a practical approach to government. In 1969 the California Advisory Board on Underwater Parks selected the same site as its initial effort to create an underwater parks system for the state.

A survey of the area was made, boundaries were drawn and a written proposal, including an inventory of marine life, was prepared. Like a long-dormant flower, the idea burst on city planners who took two actions simultaneously: The city rejected the proposed *state* park plan and announced plans to designate the area a *municipal* park.

The city ordinance not only created the park but established a seven-member Underwater Parks Board to oversee operation and set policy. The board appointed as its first chairman Dr. William A. Nierenberg, director of the Scripps Institution of Oceanography.

The San Diego/La Jolla Underwater Park is today perhaps the most active underwater park in California. It extends from Point La Jolla northward for some seven miles, from shore to about a mile offshore, for a total park area of just under 3500 acres.

Significantly, an ecological reserve was incorporated within the park. This look-but-don't-touch area embraces the southern one-sixth of the park and is marked by five buoys. The removal of anything from this reserve is prohibited, and the rule is strictly enforced.

When the park was dedicated in 1970, scattered beds of giant kelp were being decimated by indiscriminate boat use and other stresses. Today there is a healthy and flourishing kelp bed in the reserve area and another near the northern boundary. These kelp canopies provide a habitat for marine life and are, in themselves, a worthwhile sight.

Early in 1971 the City Parks Advisory Committee decided the barren north end of the park needed more marine life. Scientists from Scripps volunteered a study, and later recommended implantation of an artificial reef. Not only would the reef enhance the natural attributes of the immediate environment, but it would provide a new and productive spot for recreational fishermen since the reef would be located well outside the ecological reserve area.

The committee at once rejected the idea of dumping old tires or used trolley cars into the sea. Instead, natural rock was agreed upon. After two years of public hearings and painstaking assessment, Catalina Island quarry rock was selected. Two more years dragged by while layers of mindless resistance were peeled away and a seemingly endless parade of bureaucratic requirements were finally fulfilled.

Finally in April of 1975 some 3000 tons of rock was barged to the site and dumped on the sea floor at a depth of 40 feet. A buoy was set to mark the location for divers and fishermen.

Within weeks small plants began to appear on the reef. In the years since, more and greater plant life, fish and crustaceans have come to inhabit the place, thus verifying not only the theory but the purpose for which the reef was intended. More than 200 species of fish and crustaceans have been identified in what is now the park area. Starfish in great variety, jellyfish in equal distribution, lobster and abalone can be found. Pods of California gray whales pass through the park during their annual

migrations to warm southern waters.

The park contains two unusual geological features, the Scripps and La Jolla Canyons. These two canyon heads are actually branches of a very large submarine canyon which splits two miles offshore. Each of the canyon heads is within swimming distance of the beach and begins at about 50 feet. They form spectacular gorges that slice through a terrace formed 14,000 years ago when the sea level was much lower. The deep canyons are ideal natural laboratories for studying sea floor processes, as shallow-water sediments slowly creep into deeper waters, the same way glaciers glide down mountain sides to the valleys below.

From March through September, park visitors can witness one of the most remarkable life cycles in the sea — California grunion coming ashore to spawn. Unlike any other fish, grunion leave the water completely to lay their eggs in wet sand. As if this behavior weren't strange enough, grunion make these excursions only on particular nights, depending on the tide, with such regularity that their arrival can be predicted a year in advance. Shortly after high tide on certain nights, particular sections of the beach are covered with thousands of grunion performing their mating rituals.

Grunion are between five and six inches long with bluish-green backs and silvery sides and bellies. Females ride a long reaching wave onto the beach accompanied by as many as eight males. In their presence, she literally drills herself into the sand, tail first. Often, only her head remains exposed. The males curl themselves around her with their vents close to or touching her body. The female twists in her hole, emitting her eggs two or three inches below the surface.

After the milt is discharged, the males swim back to the sea. Shortly thereafter, with a violent, jerking motion, the female frees herself and takes the next available wave back out. The entire episode takes about 30 seconds, although individual fish may remain on the beach for several minutes.

Early in 1971 an underwater TV camera was placed permanently in the park. Located 2000 feet offshore, north of the ecological reserve, the camera is anchored to the sea floor at a depth of about 40 feet. A monitor located in the Scripps Aquarium forms the centerpiece of an imaginative display. It is, perhaps, the only such live television display in the world that focuses on the daily activities of an underwater park.

As the decade of the 1970s matured, the concept of preserving and protecting near-shore marine environments gained greater acceptance. In California alone there are now eight underwater recreation areas, and the idea has begun to take hold elsewhere.

Among the most famous underwater parks is Buck Island off St. Croix in the Virgin Islands. This tiny underwater park is guarded by a spectacular reef. The water is warm and clear. Access to the island is by boat — regular charters run from Christiansted to the island, a distance of about six miles. No tanks are permitted in the park, a wise precaution against destruction of the fragile corals. No spearfishing, either. A delightful help to snorkelers is the presence of brass plaques affixed to the bottom at strategic places to explain the sights or give simple directions. And since the water is barely 25 feet deep in the park, nearly anyone who can survive a bathtub can enjoy its special beauty.

Japan, Australia, Norway, Israel, Canada and Mexico have also created wet parks. Japanese parks are largely organized on a national system, and prohibit swimming and diving. Look-see is accomplished by entering a silo at the end of a pier. The visitor descends into the silo to a depth of about 30 feet and can observe the underwater panorama through a series of portholes set in the walls.

Wreck diving and cold water typify Canadian parks. Well-managed Canadian parks such as Fathom Five Provincial Park in Ontario show clearly that freshwater environments can be made into tourist attractions by emphasizing their own special characteristics.

In the past two years the Mexican government has taken bold steps toward creating not just a single underwater park but an entire system. Perhaps the most spectacular of these is one embracing Palancar Reef on the leeward side of tiny Cozumel Island. It is a gorgeous wall covered with holes and caves, pinnacles and seamounts, abounding in color beyond description. To many divers, Palancar Reef is the eighth wonder of the world — it must be seen to be believed.

On a survey prior to creation of Palancar Park, some 79 species of fish were identified over an eight-day period along with nearly two dozen different kinds of invertebrates and a plethora of coral species. French and queen angelfish, barracuda, cardinalfish, electric rays, parrotfish and even a glimpse of the rare frogfish delighted our survey team. At few other places on earth can a diver exhilarate in what he sees and senses more than at Palancar.

Overlooked by too many underwater park enthusiasts is the reality that there are more non-divers than divers. If the concept is to maintain its momentum, non-divers have to be turned on to what we see through our faceplates. To that end, some imaginative strides have been taken and exciting plans made.

San Diego's underwater TV provides shirtsleeve visitors a chance to enjoy the ocean deep, even if vicariously. Glass-bottom boats at Pennekamp and Catalina are another means of involving the non-diver. Even movies portraying rarely seen white sharks have a certain value. Certainly the Cousteau documentaries have established monumental support for preserving the marine ecology.

In my lifetime, I fully expect to see street-clothed people walking along the floor of the ocean. They'll move through an acrylic tunnel, ten to 12 feet in diameter, with its entrance located on the beach above the high-tide line. In places, the walkway will be tethered several feet above the sea floor, permitting visitors to look down at the ongoing life beneath their feet.

Silos and even tourist submarines are not far off. There are plans, well beyond the pipe-dream stage, for underwater restaurants entered above from a fixed offshore platform. Imagine watching your main course swim by as you sip your cocktail.

Don't laugh too loudly — think of those who giggled at the exploits of the Wright brothers.

Underwater parks are created to preserve the "now" in all its splendid characteristics, to enhance and protect these fragile seascapes so that future visitors may see and understand the ocean and its direct relationship to the way we live. These parks are the glittering gems in our inventory of priceless natural treasures, and must be nurtured and protected with care — they are tangible expressions of our respect for the profound mysteries of the natural world. We must be conscientious caretakers — they are our gift to the future.

Seapro EVOLUTION

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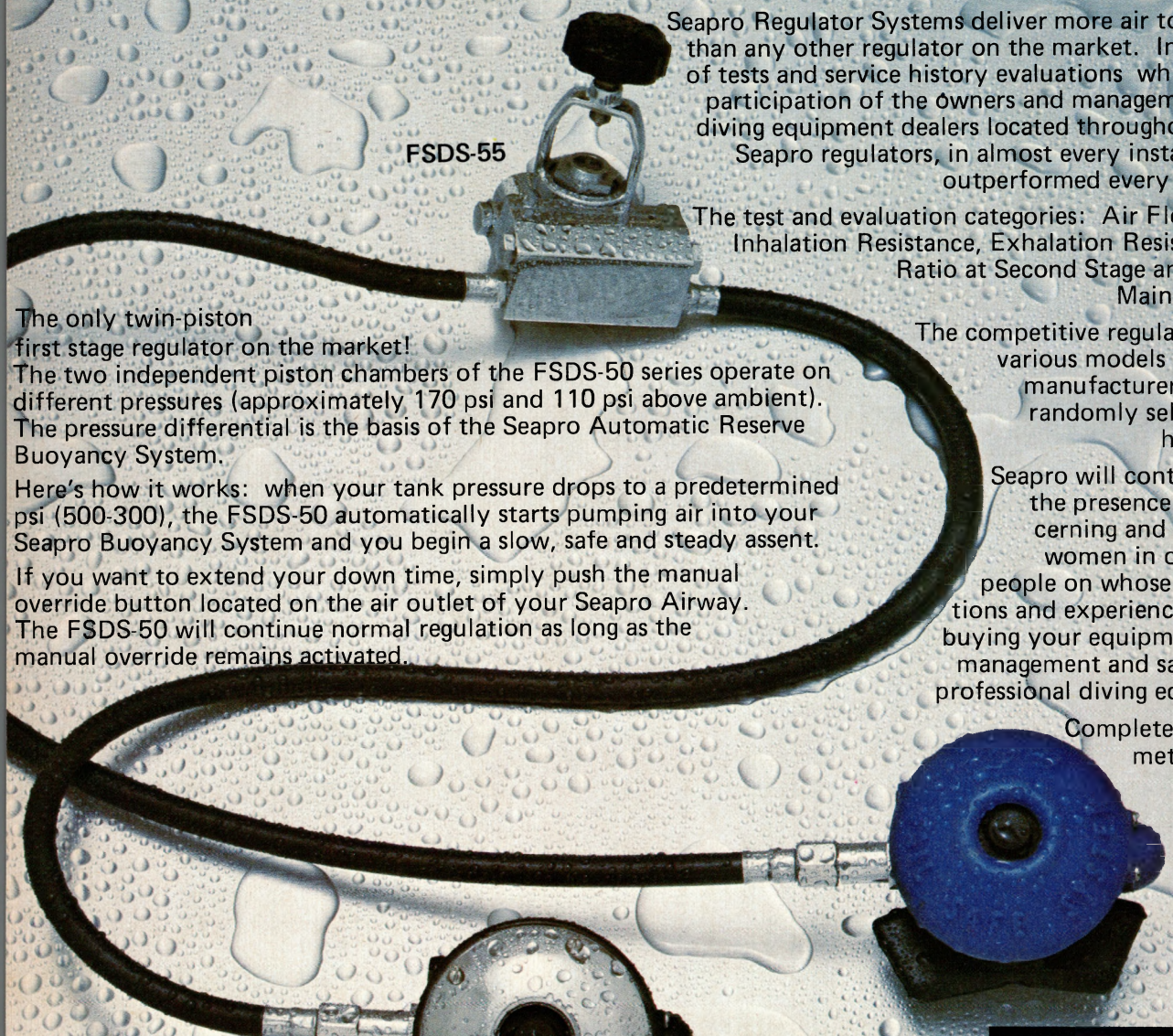

Seapro Regulator Systems deliver more air to the sport diver than any other regulator on the market. In fact, in a series of tests and service history evaluations which included the participation of the owners and management of over 100 diving equipment dealers located throughout the country, Seapro regulators, in almost every instance, equaled or outperformed every other regulator.

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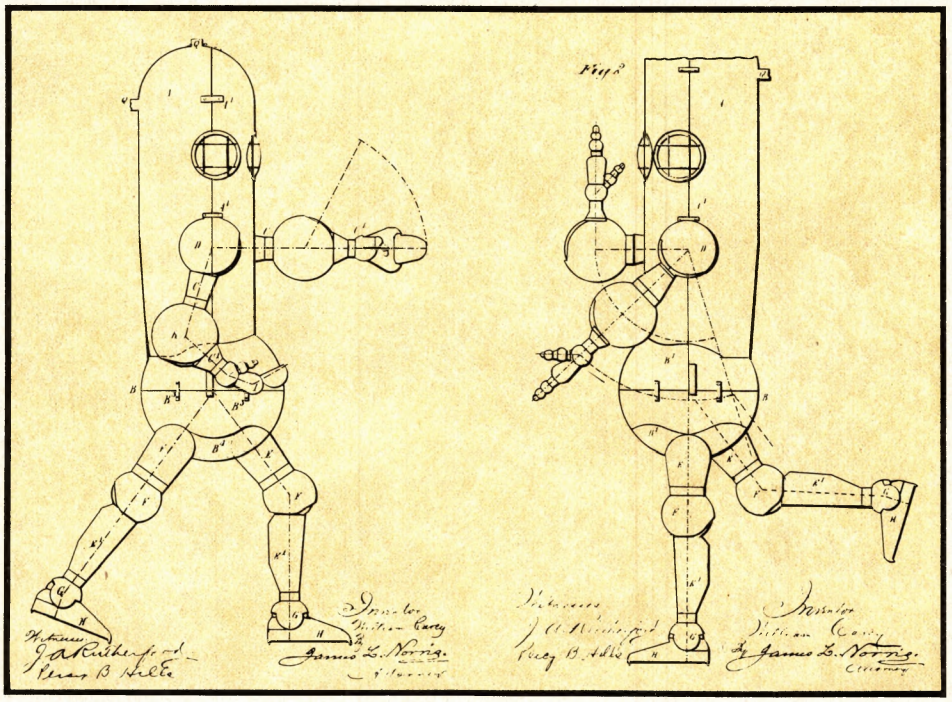
History:

Patent Nonsense

If you thought duckfoot fins and chest-mounted regulators were awkward, consider some of these gems from the U.S. Patent Archives.

BY RO SHEFFE



"People have gone crazy in there," remarked Jay Wenzel, pointing to a group of modern glass-and-steel buildings as we approached. He should know. Those buildings housed the U.S. Patent Office Archives, and Wenzel, a Washington patent attorney, was more familiar than most with the arcane inner workings of this ancient warehouse of ideas.

"You'll see what I mean. For example, let's assume you wanted to search the files for patents on pants. Where would you look?"

I considered. "Trousers?"

"Not even close."

When Senior Editor Ro Sheffe left to research this piece his assignment was to write about the significance of the use of conch shells in West Indian courtship rituals. When asked about the discrepancy, he claimed he "got on the wrong airplane."

Let's see, an older term, maybe. "Breeches?"

"Nope. Try 'bifurcated nether garments.'"

I was beginning to get the idea.

Inside those buildings, stacked floor to low ceiling, in letter-size pigeonholes, are more than four million documented examples of human creativity in its most brilliant and most bizarre expressions. They are recorded on loose sheets of paper stapled together and bunched into four-inch stacks, each document containing a draftsman's sketch of the patented object and several pages of "a full, clear and exact description thereof." An amazing number of the oldest patents from the 1800s, back when paper was built to last, are original documents—brittle, but still whiter and more legible than later patents. Many of the early- and mid-1900s documents

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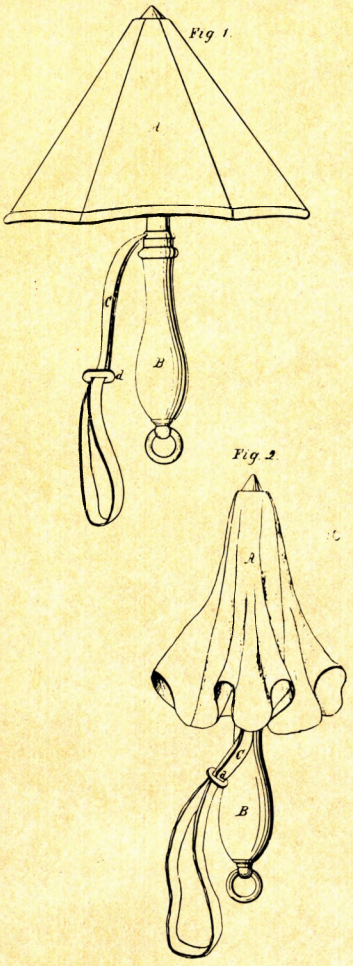


SWIMMING PROPELLER
March 5, 1861
Patent Number 31,608

In 1861 Jacob Kleiber of Memphis, Tennessee wrote one of the shortest patent claims on record. It follows.

"This device is designed to be attached to the wrist by a strap, and while swimming the forward motion of the hand tends to close the frame; upon drawing back the hand, the resistance of water causes the frame to open and draw the operator forward."

It must have been slow going, but still you have to admire the absolute purity of thought.

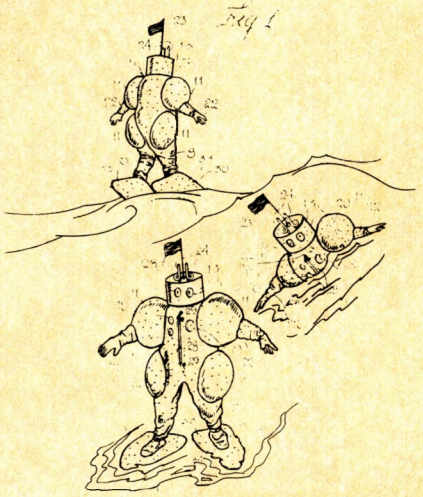
LIFE SAVING APPAREL
February 2, 1918
Patent Number 1,268,806

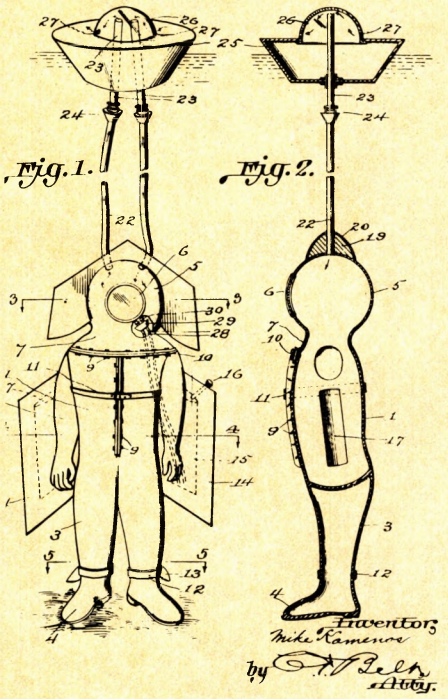
Whoever coined the phrase "you can't walk away from a shipwreck" overlooked the ingenuity of Mike P. Vukosav, "a subject of Austria-Hungary residing at Oakland, California."

Drawing his concept from early diving suit design, Vukosav envisioned a drysuit with a difference: "foot paddles to afford means for sustaining the wearer in a perpendicular position on the water."

Vukosav thought of everything. His suit sported two corkscrew snorkels, a "steel shell head covering," three chest-mounted "glass covered openings for the admission of light," a port through which "the arm may be extended for throwing refuse matter from the interior of the garment" and even a helmet flag indicating the nationality of the wearer. Balloon-shaped "spaced lateral extensions" at the shoulders and hips provided buoyancy.

These must have been great fun in high seas providing one didn't slip and fall on his lateral extensions.





WEARING APPAREL FOR DIVING
July 8, 1920
Patent Number 1,369,669

Mike Kamenos of Washington, DC built "a novel and peculiar diver's appliance for suspending a human body under water." This he accomplished with "a body suit composed of rubber, having fingered sleeves, legs and shoes." A "cork fin" mounted on the "head member" secures a pair of rigid metal air pipes leading to a cork-and-glass buoy on the surface—just don't look down.

An interesting feature of Kamenos' invention is the provision of hollow cork fins "secured on each side of the body member" to "facilitate diving" and to "store drinking water and food." Kamenos says it works like this: "The water chamber has a pair of pipes leading from the chamber through the body member into the breast member, and said pipes are attached to a holder having mouth nipples free to be handled by the wearer as desired within the head and breast members."

have become too fragile to handle, and were replaced in the files by photocopies long ago. The place smells of well-worn oaken library furniture and dusty heirloom bibles. It's not a library and there are no "quiet, please" signs, but people whisper anyway. The sheer mass of all that paper seems to inspire a respectful silence. No one stands up quite straight.

Wenzel took me to a cashier's window where I had the option of buying tokens for the photocopy machines in three-, nine- or 15-dollar bags. I hadn't expected this.

"Go ahead and buy a bag," he advised, "You can always sell back what you don't need. We'll buy them."

I bought a three-dollar bag and followed Wenzel across the street to have my credentials checked for a blue laminated ID card to hang on a chain around my neck. We passed through the turnstile where a guard checked my new ID. I was shown the reference section,

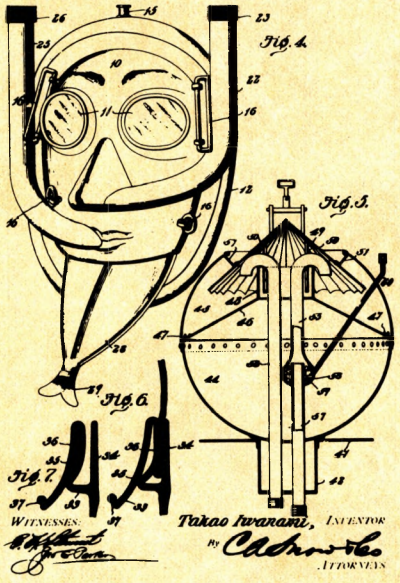
DIVING APPARATUS
March 26, 1906
Patent Number 835,950

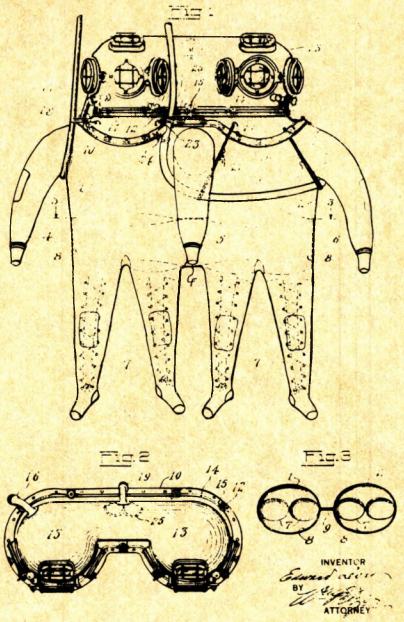
In 1906, Takao Iwanami, "a subject of the Emperor of Japan," somehow invented "an apparatus being of such a nature as to render the diver independent of any mechanical apparatus for supplying air." Marine philosophers still debate the implications of this statement.

The invention Iwanami describes is a "mask formed of metal" which "acts to exclude all fluid." Water, however, collects in a banana-shaped projection at the chin to be drained through "an opening that is normally closed by a threaded plug."

Tubes thrust up from the mask into "an approximately globular vessel constructed of sheet metal." Air is drawn through the nose-tube and blown out the mouth-tube where it passes through a sponge soaked in "some volatile liquid, such as ether, which by evaporation will induce the flow of air upward, so vitiated air will not be retained to the injury of the diver."

Remember, inhale through the nose.





DOUBLE DIVING ARMOR
February 8, 1926
Patent Number 1,643,667

Why would anyone want a Siamese suit? Let inventor Edward Levy explain: "A twin suit having a single helmet permits conversation, allows training of new men and may be used by professional divers taking down lay observers for mere sight-seeing, general education, amusement or curiosity."

This arrangement, of course, has its problems, but Levy strived to mitigate them: "A wide reinforcing waist-band extending to the crotch is employed to guard against ripping the body part due to difference in stride of the two persons wearing the armor."

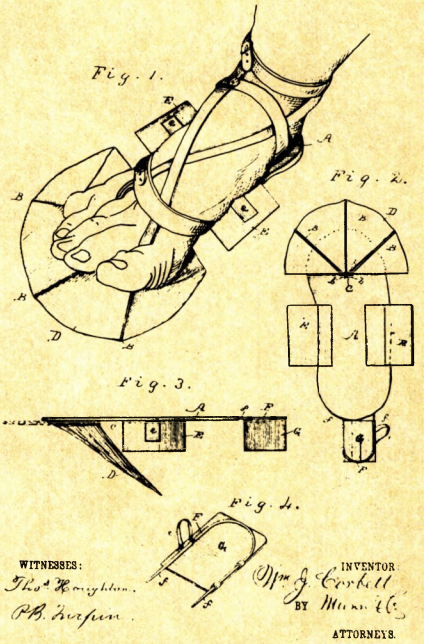
The careful observer will notice the fact that only three sleeves are provided. "The middle sleeve is used by either of the divers," writes Levy, "and when used by the diver in the right suit, his left arm will be in the middle sleeve and the right arm of the other diver will be around the waist of the first diver. This enables the two to steady themselves and readily keep in step while walking." Anita Bryant will love this one.

SWIMMING APPARATUS
November 14, 1885
Patent Number 335,015

In 1885, William James Corbett of Tucson, "Arizona Territory," invented a swim fin which "will be found of great assistance to swimmers, especially those not particularly expert in the art."

Corbett's design called for a ribbed fin blade pinned under the sole "to feather the blade when the device is being drawn forward for a new stroke." The blade is formed of thin metal ribs "covered by a sheet of parchment or similar material."

Anxious to thwart potential patent poachers, Corbett specifies his claim applies not only to foot propulsion, but "where desired the sole and carrier plate may be used upon the hands."



classification lists, the North Stacks, the South Stacks and "Group," the central clearinghouse for documents undergoing reclassification. I couldn't have known then that I'd spend that three-dollar bag of tokens and almost 50 dollars more in the next three days, coming away with a stack of photocopies so thick I had to give away two books to get it all into a suitcase.

Wenzel was in a hurry, on his way to a round of speaking engagements in Canada. "Any questions?"

This was it—last chance—did I have everything? Tokens, badge, lists and a vague idea of the classification system all seemed within reach. But among 40,000 categories, "scuba" never appears.

"Wait a minute. Scuba diving equipment—where should I start?"

Wenzel shot me a wry, so-you-thought-lawyers-had-it-easy grin. "Look under 'Surgery, comma, Bandages'" he said. He was right.

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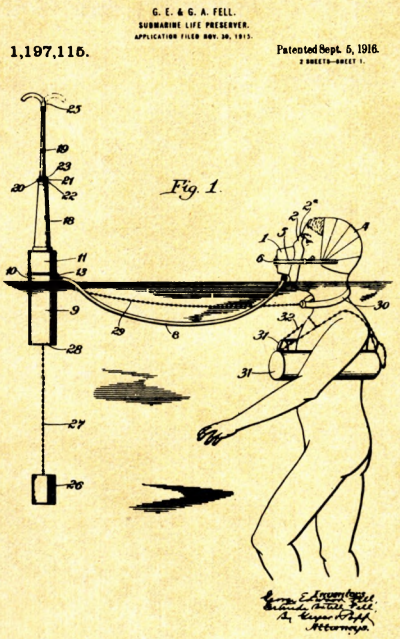


SUBMARINE LIFE PRESERVER
November 30, 1915
Patent Number 1,197,115

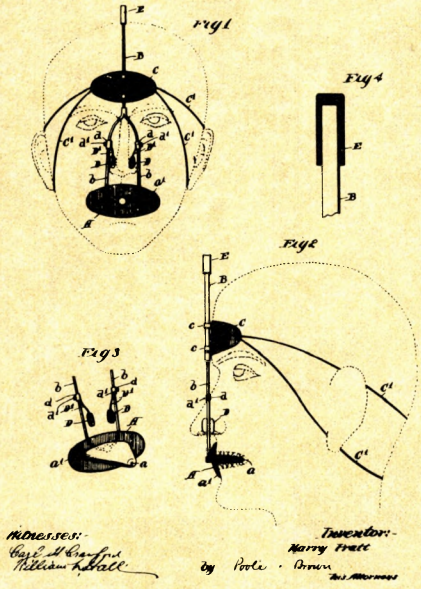
Apparently fed up with flimsy face masks, George Edward and Gertrude Axtell Fell of Buffalo, New York made a snorkel with a mask built to last. "The face mask is approximately cup-shaped," declare the Fells, "and constructed of galvanized iron." In order to prevent "undue strain" on the air tube, "a safety connection, preferably consisting of a strong chain, may be attached to the float and the body of the user by means of a neck collar."

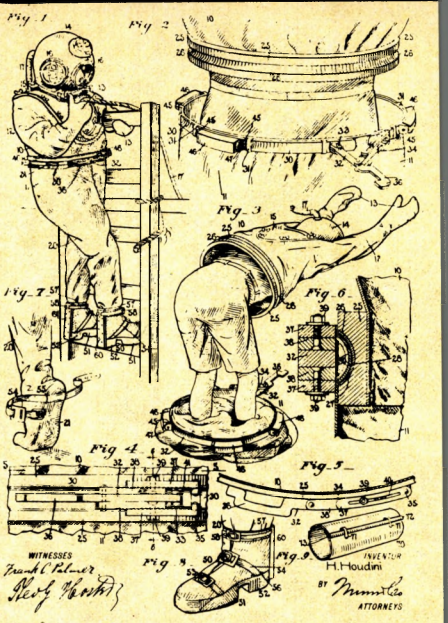
Ballast for the snorkel float is provided by a weight "of the proper heft to keep the float upright" consisting of "a can or receptacle filled with lead or other heavy material" and attached with more strong chain.

"It is advisable," the Fells point out, "to use a life preserver of any ordinary construction" secured to the diver by a harness made of—you guessed it—"strong chain."

APPLIANCE FOR SWIMMERS
August 16, 1901
Patent Number 690,663

By 1901 Harry Pratt of Kenilworth, Illinois had had enough of bulky breathing gear. The snorkel he invented was light, compact and practically useless. Fastened with "strips or tapes adapted to be tied about the head," Pratt's "novel appliance" consisted of a snorkel tube about the diameter of a cocktail straw "secured to the head of the wearer so that it may retain its position with its upper end directed upwardly; said tube extending to the vicinity of the top of the head." Leading snorkel historians believe the device may have been responsible for the epithet "Big Bore" Pratt.



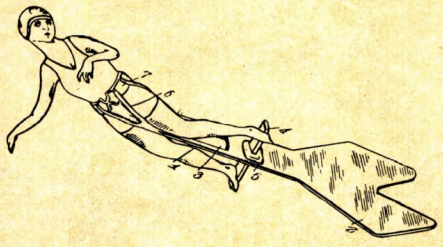


DIVER'S SUIT
June 30, 1917
Patent Number 1,370,316

Who but master magician and eminent escape artist Harry Houdini could invent the ultimate failsafe, quick-release diving suit?

Houdini's remarkably sophisticated suit differed from traditional designs in that it could be shed by a diver without removing the helmet or breastplate. One quick pull on a waist-mounted lever drops the suit's pants, allowing the diver to pull free of the top half of the suit "aided by the resistance of the water which rushes in." Stiffening plates mounted on the heels "prevent the rear portions of the shoes from collapsing onto the back of the diver's feet, thus holding the diver's feet against slipping out of the shoes."

The meticulous craftsman not only conceived the idea, but drew his own patent sketches, built a working prototype and tested it extensively. The bottom line: "By actual tests it has been proved that not only a diver but an inexperienced person can escape from the suit in less than 45 seconds."

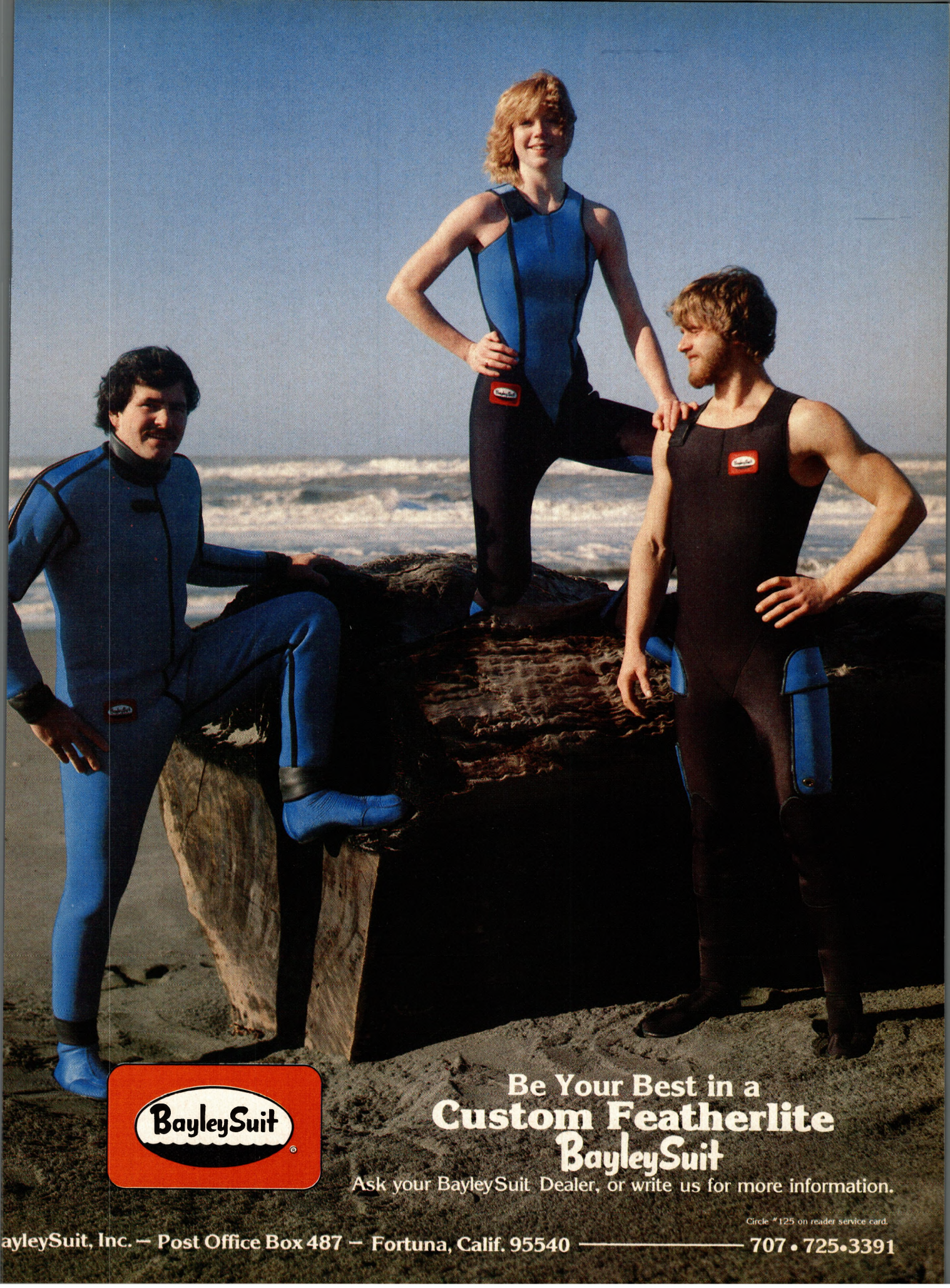


SWIMMING APPLIANCE
May 27, 1924
Patent Number 1,530,560

If fish can do it, reasoned Joel R. Heminger of Akron, Ohio, why can't we? To this end, Heminger conceived a rather huge slab of solid rubber "which can be readily attached to the swimmer and which has a tail portion adapted to be moved from side to side to simulate the movement of a fish."

Strapped in and ready to go? Let Heminger tell you what to do next: "The feet are pressed successively against the foot bar ... this will cause the tail portion to be given a sinuous motion from side to side simulating that of a fish moving through the water. This motion," concludes Heminger, "will also tend to propel the swimmer forwardly."

Or downwardly.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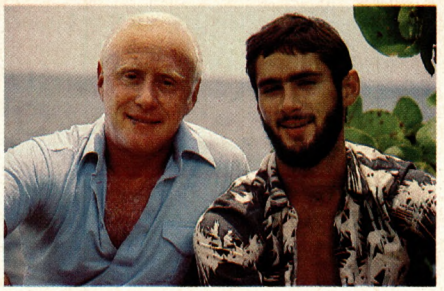
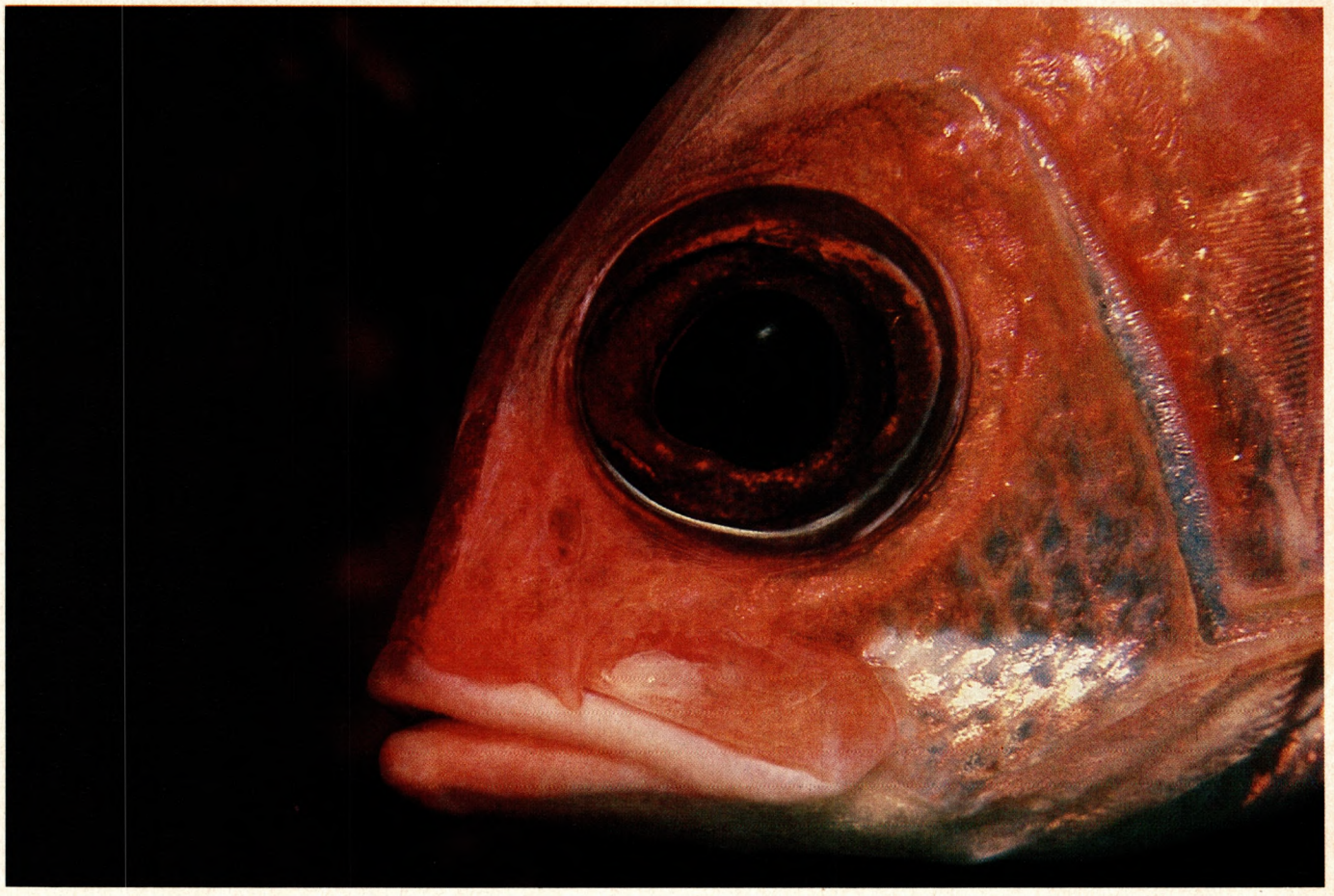


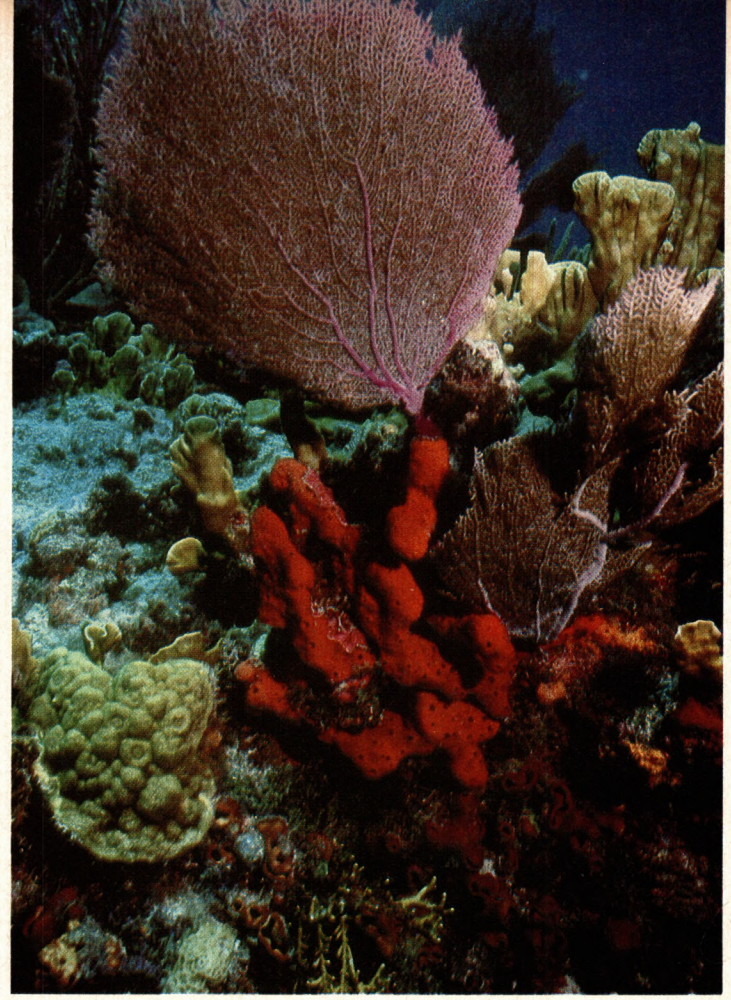
Jerry & Michael GREENBERG

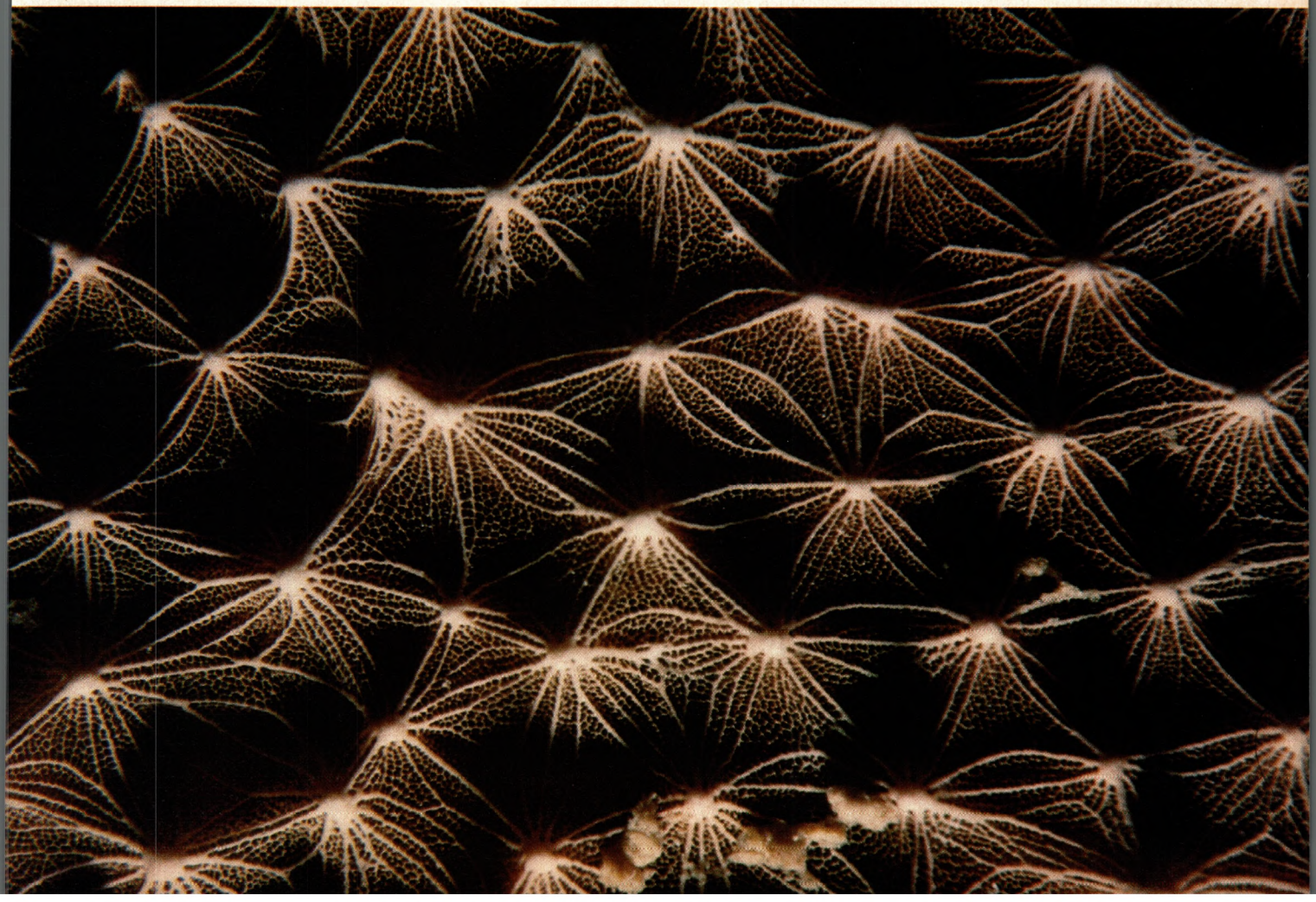
Considered by his rivals as the precursor of underwater photography, the elusive Jerry Greenberg reveals at last his latest work and that of his son, Michael.



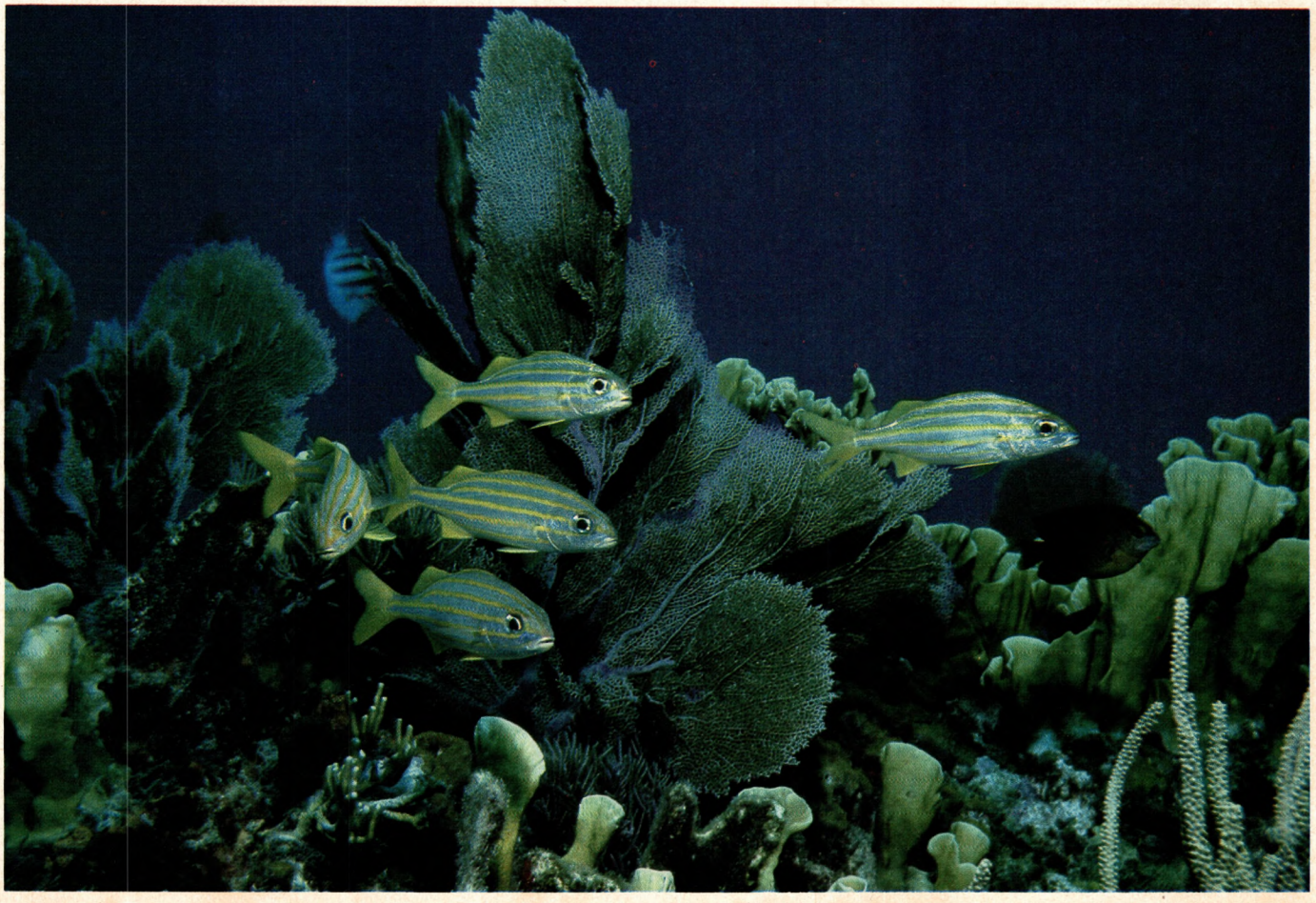
Left: Jerry's arresting study of a coral rainbow head on Palancar Reef off Cozumel, Mexico. Above: The edible, but spiny, longspine squirrelfish, Holocentrus rufus *poses for a head shot by Jerry.*

Left: The narrow, muscular jaws of the Goldentail moray, Muraena miliaris, *can imbed his fangs into anything he wants. Right: A common sea fan,* Gorgonia ventalina, *serves as a backdrop for the elder Greenberg's portrait of a red wall sponge,* Haliclona rubens. *Below: A delicate warp and woof pattern is seen in Michael's depiction of a sponge.*





Facing page: Threespot damselfish, Pomacentrus planifrons, *eyes Michael as he guards his Cayman Island territory. Left: Distinctively branched flower coral,* Eusmilia fastigiata, *open to feed only at night. Below: Smallmouth grunts,* Haemulon chrysargyreum, *dart in and out of a sea fan hideaway.*



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FOR YOUR INFORMATION *by Ro Sheffe*

Dr. Sylvia Earle to Direct Marine Ecology Course

A ten-day marine ecology course for high school and college teachers will be conducted this summer on the Yucatan coast of Mexico. Participants will snorkel and dive an offshore barrier reef, study the terrestrial biology of the Yucatan, and visit Mayan archaeological sites. The course will run July 25 to August 4, directed by Dr. Sylvia Earle, research biologist at the California Academy of Sciences, and Dr. Harold Humm, marine biologist at the University of South Florida. Contact Jere Hallenbeck, Science Education Afield, 1425 Erie Blvd. East, Syracuse, NY 13210.

This Little Spoon? It's For Eating Polar Bear, Officer.

According to the Associated Press, the Marine Mammal Protection Act is being creatively violated by rural Alaskan villagers who trade polar bear hides for cocaine. The Act allows native Alaskans to hunt polar bears "for subsistence," but prohibits sales to non-natives. Bartering is brisk, however, and federal officials in Fairbanks say the new coke trade in rural Alaska is responsible.

EVERETT DAVIDSON

Help Stop the Reef Ripoff

Each year tons of coral is plundered from some of the best dive sites in the Caribbean. Much of it makes its way to the United States, either hand-carried home or sold wholesale to the curio trade. The practice has left many types of coral near extinction, and existing prohibitions against the import of only those species have proved difficult to enforce. Copies of a petition calling for ban on coral imports are available from: Petition, Box 370293, Miami, FL 33137.

Now You See It, Now You Don't

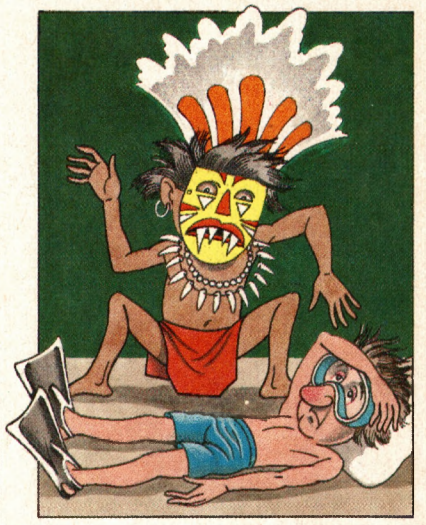
Diving, thought the Miami Tourist Council, would be a great subject for a poster campaign to introduce a new ad theme: See It Like a Native. Outraged women's groups saw it differently. No one objected to promoting diving, but several thousand seemed to think something more lurid than diving was being promoted here. The county commission agreed, but 50,000 posters had been printed and 22,000 mailed out to tourist agencies by then. The rest are now stacked in a locked vault. Well, almost. A few thousand pirated posters are being hawked as collector's items by local entrepreneurs, and the cancelled campaign made national news, guaranteeing a far wider distribution than the tourist council could have hoped for. An ad exec not affiliated with the agency that created the campaign offered another view. "I wouldn't object to the poster," she said, "If Miami law didn't prohibit me from diving topless."

Show Your Colors

New promotional materials on the theme "Discover Diving" are now available through the Dive Equipment Manufacturers Association. Shops enrolled in the program will receive a large color window poster, and 25 identical mini-posters (11" x 14") for distribution in the community. Good graphics, good photography and a message: your shop's location and next class dates. Also included are 50 bumper stickers bearing the Discover Diving logo. And it's all free. Contact DEMA, P.O. Box 4067, Irvine, CA 92716.

Private Group to Reactivate *Tektite*

An ambitious underwater research program now underway in San Francisco will double the size of the U.S. fleet of active underwater habitats (at present, only *HydroLab*). The first project, slated for early 1981, will be an investigation of an aging nuclear dump site 50 miles west of San Francisco where more than 47,000 barrels of radioactive waste were sank between 1947 and 1966. *Tektite*, a complete underwater research laboratory with living facilities for five at 50 to 150 feet, supported missions in the Virgin Islands from 1969 to 1973, but has lain dormant since. She was brought out of mothballs, moved to San Francisco and extensively refitted last year by Project Tektite, a nonprofit corporation funded by industry, universities and individuals. The habitat will be made available to research groups at cost, while maintaining vocational training programs in marine sciences and industrial fields. Contact Dr. Hal Ross, Project Tektite, 1463 Funston Ave., San Francisco, CA 94122.



EVERETT DAVIDSON

Beyond Paregoric

Emergency medical help for travelers in remote areas is now available through the SOS Medical Service Program. For a membership fee of $10 weekly, $25 monthly or $100 annually, SOS members have at their disposal an array of services ranging from telephone consultation with an English-speaking physician to medical evacuation airlifts. SOS will fly in a friend or relative if a lone traveler will be hospitalized more than seven days, and any dependent children will be flown home. Contact International SOS Assistance, 1420 Walnut St., Philadelphia, PA 19102.

continued

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And the pay for well-trained deep sea divers is high—about $200 a day on the West Coast to about $125 a day in the East. Pay is still higher for work overseas where the demand for qualified deep sea divers is growing rapidly. You can literally pick any part of the world where you want to work.

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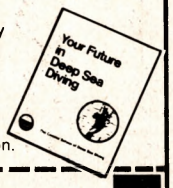

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A Conversation with John Englander

The new president of NAUI talks about changing priorities in the agency's future.

The National Association of Underwater Instructors has a new president. That's not remarkable; one is elected every year by the board of directors. What is remarkable is that this new president John Englander, has a mandate from the board to re-evaluate and reorganize this pioneering, but essentially conservative, organization.

Englander, 30 years old and a NAUI instructor for 12 years, should be quite the man for the job. In 1974 he took over an ailing Underwater Explorer's Society in Freeport and turned it into one of the most profitable dive resorts in the Caribbean.

NAUI is a self-governing nonprofit association. The members elect the board and the board elects the president. Together they hire an executive director who hires a headquarters staff to service the members. Some in the scuba community have mistaken the necessarily slow workings of this bureaucracy, and its conservatism, for pure muleishness.

Englander feels that NAUI has been slow to recognize its own management needs and the changing needs of its students. This has put the agency in a less than favorable position in marketing and finance.

Part of NAUI's problem has been its management structure: eight part-time directors who have kept very close control of day-to-day details.

"What we've agreed on," Englander said, "is that the board will dramatically, more than ever before, turn over the responsibility for getting us to achieve certain goals to the management—the executive director and his staff.

"Whether or not NAUI was healthy financially at the end of the year was not focused upon. Now we've realized that, in order to reach our educational goals, we have to be a viable business."

Englander hopes to put NAUI on a firm financial foundation.

A new Industry Support Director, Harry Averill was hired several months ago, and Englander is directing the search for an Executive Director to replace Ken Brock, who resigned last month for personal reasons.

One thing that won't change, Englander said, is NAUI's commitment to quality education.

"NAUI is going to continue to assert its identity with quality in diving education, but we have a number of marketing problems in our programs. The way our different course offerings are stepped up, the progression of divers to higher certification levels, really are not very effective in terms of market appeal.

"Quality is vitally important to us, but packaging is important too. What we call a certification—basic or sport or open water—does make a difference. We want to make it more appealing and more fun to become a NAUI diver.

"Less than one percent of the population of the U.S. has tried diving; there's probably ten or 20 times that number who would like to try it. There may be 15 or 20 million people who are in good enough physical shape, have the curiosity and financial ability to try diving. That's our market, those are the people who need quality education."

To get those new divers, Englander would like to see NAUI direct more of its advertising and promotional efforts outside of the diving industry.

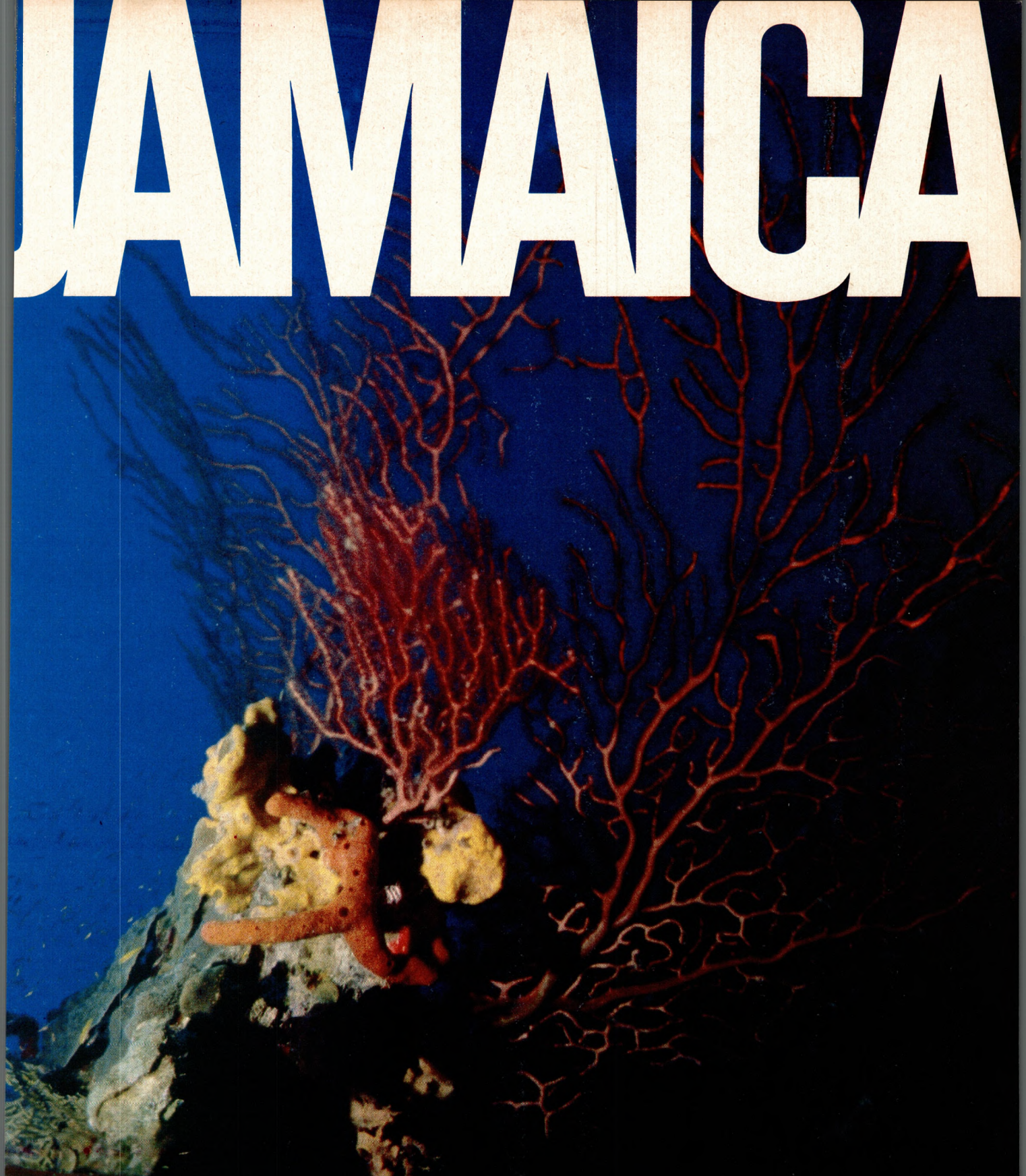
"We need to put information about diving into the hands of people who would like to try it and have never been told how or where. *Adventure Travel, Playboy, Newsweek*, radio, cable TV, there are lots of ways to reach them.

"NAUI is unique among the instructional organizations for a variety of reasons. It's 20 years old, it was started by a group of instructors who felt the need for professional standards in education. As it grew in the late 60s and early 70s into a business supplying a million dollars worth of services to its subscribers it needed to manage itself differently, but it never quite made the transition."

The board of directors, by electing Englander, has signified its desire to get on with that transition. And Englander, at least for one year, will be the man who manages and directs it.

—*Steve Blount*

JAMAICA



Jamaica is a sea of treasures. Deep beneath its surface as well as above. Dive into our clear warm waters and discover rainbows of tropical reef fish, dense forests of corals and rock ledges alive with colorful sponges. Explore our underwater caves and visit our shipwrecks. Shipwrecks that went down when our 18th century Great Houses were going up. Jamaica has a lot to look into. **Because we're more than a beach. We're a country.**

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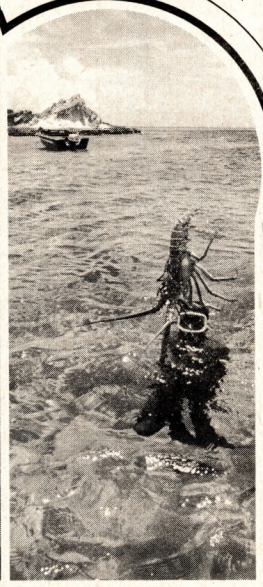
20°N 72°W As close to Paradise as this world offers! Beyond the Bahamas Closer than the Caribbean —



The Turks and Caicos offer you 200 miles of deserted ivory beaches, crystal seas, untouched reefs — and a way of life out of this world. Privacy, seclusion and personal service in small inns and hotels — scattered around our archipelago. A postage stamp size British colony — known mainly for our stamps — now a collector's item for the traveler who wants the unique.

For literature on Turks & Caicos and information on stamps and coins, call 305-592-6183 or write Turks & Caicos Tourist Board, P.O. Box 592617, Miami, Florida 33159.

From Miami: Air Florida departs Sun. - Tues. - Fri./ excursion fares & group rates available / **305-592-8010**
From Nassau: Bahamasair departs Thurs. - Sat./ **305-442-8585**
Interisland Service: Turks & Caicos National Airlines daily service to all inhabited islands/ **305-592-6183**

Directory of Dive Operations Turks & Caicos Islands - 1979	Year-round Diving	Instructor	Flat-top/ Boat	Beach	Pool	Tennis	Water Sports	No. of Tanks	Max. Group
GRAND TURK									
Pepcor Ltd.: Front Street Package and group rates for Turks Head Inn and Salt Raker Inn Contact: Phil Pruss Phone: 2432	x	x	B	x	—	—	—	40	20
Underwater Research Ltd.: Front Street Package and group rates for Kittina Hotel Contact: Mike Spillar Phone: 2386	x	x	F	x	—	—	—	50	25
SOUTH CAICOS									
Turk-Cai Watersports Ltd. Package and group rates for Admiral's Arms Inn Contact: Earl O'Neil or Steve Parker Phone: 3223	x	x	F	—	x	—	x	70	35
Caicos Reef Lodge: East Bay Contact: The Manager Phone: 3205	x	x	B	x	—	—	x	40	16
NORTH CAICOS									
Seaquatic Divers Package and group rates for Prospect of Whitby Contact: Mike Hogg or Allen Gardner Phone: 4250	x	x	F	x	x	x	x	50	25
PINE CAY									
The Meridian Club Contact: Paul Hudson 305/358-0405	x	x	F	x	x	x	x	10	No
PROVIDENCIALES:									
Provo Turtle Divers Ltd. Package and group rates for Third Turtle Inn Contact: Art Pickering Phone: 4230	x	—	B	x	—	x	x	50	25
Latitude 22 Divers Serves Erebus Inn Contact: The Manager Phone: 4240	x	x	F	—	x	x	—	20	20

GENERAL INFORMATION ON THE ISLANDS AND DETAILS OF ACCOMMODATIONS AND PACKAGES AVAILABLE
Phone: Turks & Caicos Tourist Board 305/592-6183 or write: P.O. Box 592617, Miami, Florida 33159

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NO SPEAR-FISHING OR SPEAR GUNS ALLOWED IN THE TURKS & CAICOS ISLANDS

AIRLINES: **From Miami:** Air Florida - 305/592-8010
From Nassau: Bahamasair - 305/442-8585

Dive Turks & Caicos Islands

DIVE CENTRES 1979

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3. Seaquatic Divers
4. Caicos Reef Lodge
5. Turk·Cai Water Sports
6. Pepcor
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BEYOND THE BAHAMAS – CLOSER THAN THE CARIBBEAN

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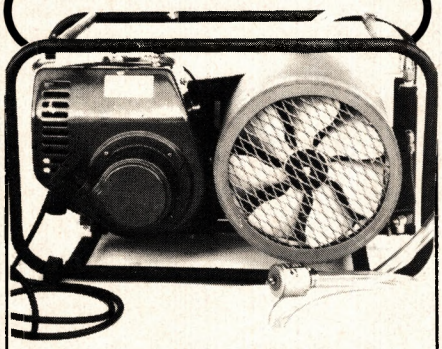
Turks & Caicos Islands Philatelic Bureau, Grand Turk, West Indies

YOUR AIR IS YOUR LIFE!



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Air compressors can be a major cause of breathing air contamination.

Why?
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Oil mist and carbon monoxide (caused by over heating oil in the compressor) can be compressed into breathing air used for filling tanks.

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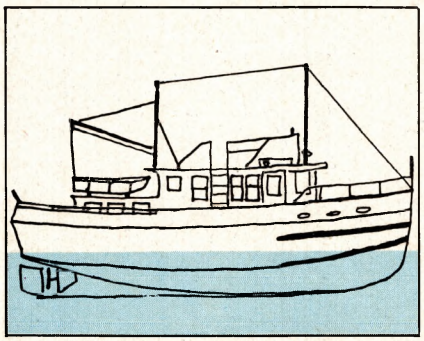
RESORT UPDATES

South Pacific

The world's most southerly coral reef surrounds Lord Howe Island in the South Pacific, 385 miles northeast of Sydney, Australia. One- and two-week tours starting at $555 and including roundtrip airfare from Sydney, accommodations and diving are available through Sealife International, 1220 West Coast Hwy., Newport Beach, CA 92663 (714) 548-7673.

Cayman Islands

New photographic services for divers are now available at Spanish Bay Resort and Spanish Bay Villas on the western shore of Grand Cayman Island. Both resorts now offer underwater camera and strobe rentals, on-site repair services for most camera gear, and overnight processing of some color slide films. Travelers to the Caymans from Los Angeles, San Diego and San Francisco can now take advantage of special $299 roundtrip fares offered by National Airlines. Contact the Cayman Islands Dept. of Tourism, 3440 Wilshire Blvd., Suite 1202, Los Angeles, CA 90010.



Truk Atoll

Charter a 42-foot, steel hull trawler for unlimited diving in Truk or as far as you'd like to go. The *Chineina* is a diesel ocean cruiser with full electronics and accommodations for four in two staterooms. The trawler recently completed a 3200-mile voyage from Hawaii and is available for charter. Contact Micronesia Aquatics, P.O. Box 57, Truk Lagoon, East Caroline Islands 96942.

Bonaire

Weekly charter flights to Bonaire, Netherlands Antilles from New York are now available through Arthur Frommer Charters. The four-hour flight departs JFK in New York on Fridays, returning the following Friday. The one-week package ranges from $549 to $669 including airfare. Second week stays start at $190. Contact Bonaire Tourist Information Office, 685 Fifth Ave., New York, NY 10022.

Jamaica

A new dive operation on Negril's 7-mile beach offers complete facilities for beginners, novices and advanced divers. Aquasports, Ltd. stocks a complete line of diving and photography equipment, and certification courses are available through NAUI or PADI. Package prices and information are available through Lotus Tours, 444 Madison Ave., New York, NY 10022.

Australia

Win an all-expense-paid dive trip for two to Australia by guessing the weight of the above mollusc. Twin Fin Dive Tours and Dive in Australia, contest sponsors, offer a grand prize valued at $7000 which includes ten days aboard one of two new dive vessels, the *Auriga Bay* or the *Reef Explorer.* Contestants must guess the weight of a giant clam shell, *Tridacna gigus,* measuring 3'6" by 2'6" by 2'6" and estimated to be 30 years of age. Contest is open to all certified divers. Winner will be announced at the 1981 DEMA show in Las Vegas. Send name, address, certification information and estimated clamshell weight to Twin Fin Dive Tours, 475 17th St., Suite 744, Denver, CO 80202.

Pacific Northwest

Tours from Seattle to Micronesia and the Caribbean this fall will be hosted by Gary Cruea through Doug Fox Travel. Tours depart Seattle for Grand Cayman Island in September, Truk and Ponape Islands in November. Contact Gary Cruea, 3407 SE 228th Ave., Issaquah, WA 98027 (206) 392-7166.

Introducing the new AQUAMAX™.

Engineered to keep water out.

What you're looking at is the first truly modern snorkel. Because until now, the basic design of the snorkel has remained unchanged for the past 2,000 years.

But Aquamax incorporates a revolutionary new engineering principle that actually prevents water from entering the breathing tube. **And does it without the use of moving parts.**

On the surface of the water, Aquamax performs much like a conventional snorkel. Only better. Because Aquamax keeps water out of the breathing tube. Even in waves and choppy waters.

Dive beneath the surface and something remarkable happens: a small pocket of air forms inside the cylinder at the top of the breathing tube. This air pocket will keep water out when you're diving. Surfacing. Or performing nearly any kind of underwater maneuver. In fact, by exerting a slight pressure on the mouthpiece, you can even keep the Aquamax dry during an underwater 360° somersault.

What it all comes down to is this: Aquamax represents a giant step forward in the technology of snorkels. So if you're still diving with a conventional snorkel, you're missing out on a brand new age of comfort and safety in snorkeling.

See Aquamax at your local dive shop. Or, if unavailable in your area, make out a check or money order to Aquamax for $12.95 (Florida residents add 4% sales tax) and send it to: P.O. Box 2643, Palm Beach, Fla. 33480. Allow 3 to 4 weeks for delivery.

Another quality product distributed by Marketing Control Corporation.
Dealer inquiries invited. Phone: (305) 832-0072.

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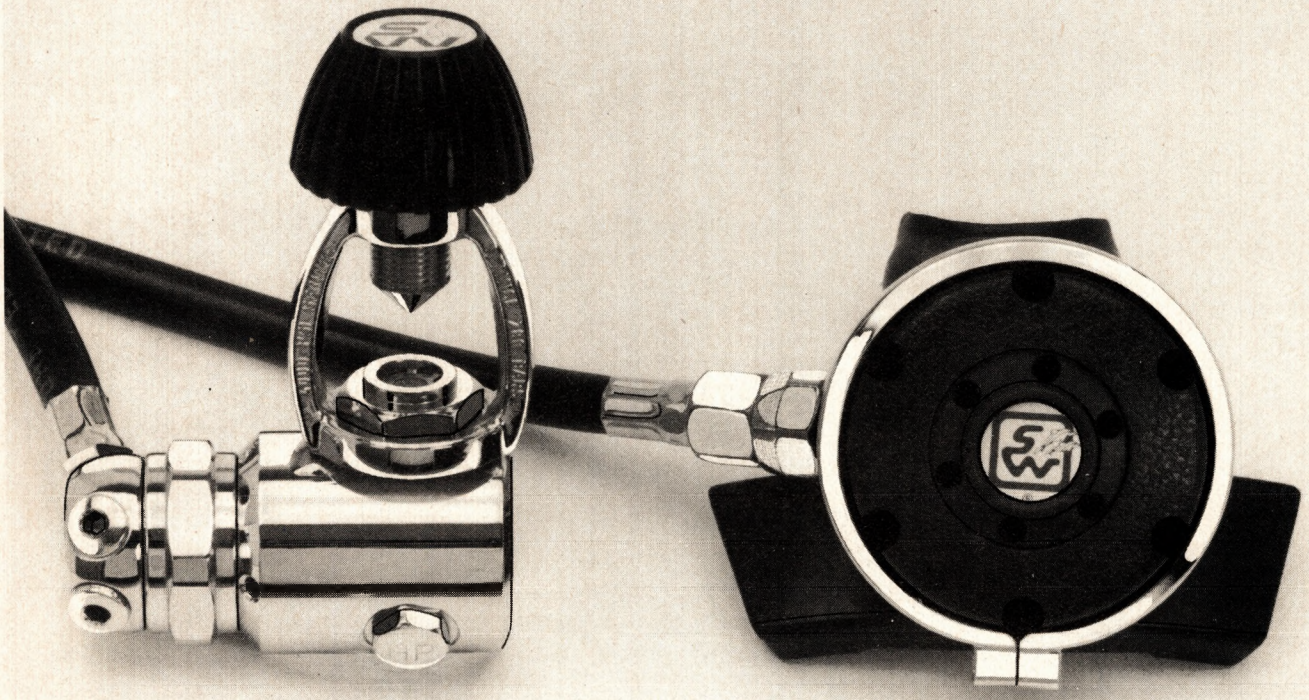
The Workhorse...
The W-900 from Sportsways.



Incorporating all the features that make diving more pleasurable, Sportsways offers the W-900 Waterlung "State-of-the-Art" regulator with the big plus: Sportsways' acknowledged reputation for reliability.

The W-900 offers two high pressure ports, four low pressure ports on a swiveling end cap, plus a swivel yoke that allows perfect positioning of hoses and gauges for each diver's needs. Two different thread sizes are used for high and low pressure ports to eliminate the possibility of improper hose connections.

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Puffer Delights

A great delicacy in Japan and the U.S., the puffer fish carries a nerve poison which can be deadly if not prepared correctly.

BY PAUL J. HILL

NANCY SEFTON

When approached or threatened the porcupine fish inflates by swallowing water as if to warn his prey that to eat him may be fatal.

The puffer fish is a paradox in that it is a great delicacy, eaten regularly, yet it is the most poisonous fish in the sea—if not prepared properly. The Japanese safely consume vast quantities of it in restaurants, yet puffer poisoning has ranked as the number one cause of fatal food poisoning in Japan. Most deaths, however, are the result of novices failing to take the necessary precautions.

The northern puffer or blowfish on the East Coast of the United States is not toxic and is recognized as a superior delicacy. The little drumstick-shaped pieces of meat command premium prices in fish markets under the name of "sea squab." The story is different in Florida. There are documented cases of poisoning from eating puffers bought in seafood markets on the west coast.

Many species of puffers develop a powerful nerve poison, and its strength varies greatly among species. Called tetrodon poison, it is one of the most violent forms of fish poisoning.

The greatest concentrations of poison are usually in the ovaries and liver, and least in the testes, skin and intestines. The weakest toxins are in the flesh (musculature), and are not lethal in quantities of less than 100 grams, or slightly under one-quarter pound. However, with most puffers, it is usually safe to eat up to two pounds when prepared by an experienced, licensed Japanese cook. But then there have been cooks who committed hara-kiri after making a mistake fatal to their diners. More than 60 percent of the victims poisoned by puffers die, and it behooves one to be very cautious in determining whether the species at hand is toxic or not. Ordinary cooking procedures do not destroy the poison.

The maki-maki, or "deadly death," and the black-spotted puffer are among the many poisonous species. They are found from the tropical Pacific and Japan to Africa and the Red Sea. The poisonous white-spotted puffer's range is from the west coast of Central America to Indonesia. The poisonous gulf puffer is found from California to Peru.

The religious rules which forbid eating "fish without scales" may have come from contact with puffer fish in the Mediterranean area. Alexander the Great of Egypt prohibited his soldiers from eating puffer fishes. The emperors of ancient Japan canceled the inheritances of warriors indulging in the deadly puffer. During World War II, it was a court-martial offense in the Japanese Army to eat these fish. The invasion troops in contact with puffers had no specialist to prepare them. In Japan today, the use of puffer fish for human consumption is rigidly controlled by public health authorities.

The puffer fish is called "fugu" in Japan, and specially trained fugu cooks prepare the puffer so it is edible. Only government-licensed restaurants are allowed to serve fugu and cooks in these restaurants must display their fugu cooking training certificates. These cooks are required to know the names and positions of all the puffer fish's organs, and the tedious procedure for preparing fugu.

The licensed chefs must know the species that are highly toxic and those that are safe to eat. They must know how to remove the poisonous parts from the fillets, how to prevent cutting open the

continued

Paul Hill is editor/publisher of ***Dive Industry News*** *and the co-author of* ***The Edible Sea****, a book considered by divers as the reference for recipes.*

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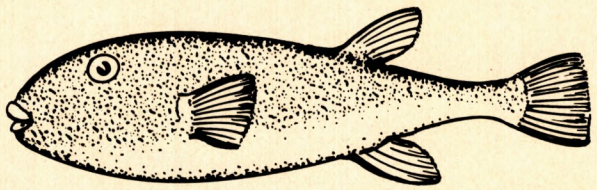
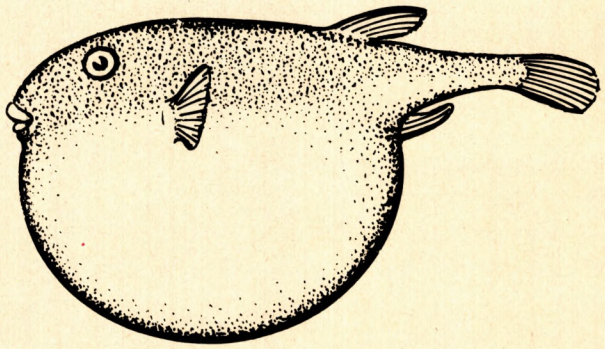
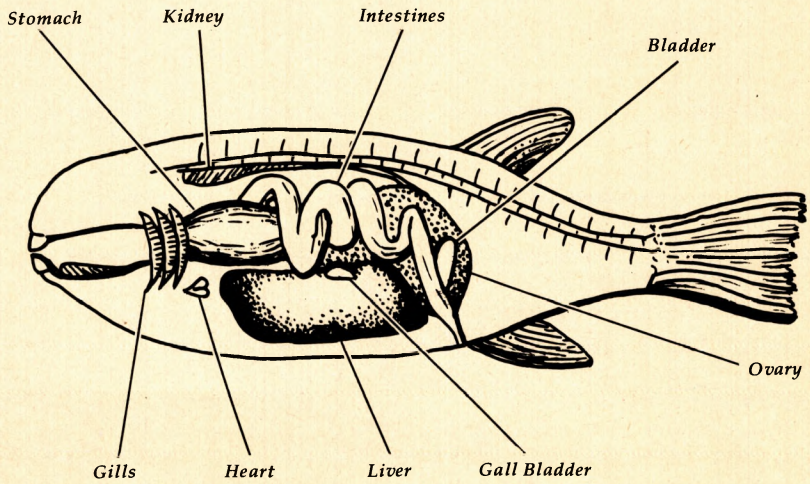


Normally Deflated



Inflated Puffer

Puffer's Internal Organs



toxic entrails that can contaminate the fillets, and the complicated procedures of preparing fugu for the table.

Some of the dishes are very colorful and decorative. Various designs are arranged on a large plate. A popular arrangement is that of an attractive flower. Small triangular-shaped pieces of fish are cut and formed into flower-shaped petals. Then they are arranged on a plate into the form of a rose or a chrysanthemum and served with vegetables, rice cake and bean curd. The finished meal is a beautiful arrangement of finger lickin' good fugu.

Naturally, all this preparation results in high prices, but the Japanese consider the puffer a great delicacy. Fugu enthusiasts in Japan consume about three pounds of the meat at one sitting,

and the aftereffects are notable, leaving a slight tingling sensation in the extremities—which diners seem to enjoy—though this seems a rather expensive method of acquiring a high.

In addition to their more common names, puffers are also known as swellfish, globefish, swelltoad, toadfish, balloonfish and blowers. Puffers get these names from their remarkable ability to inflate themselves when frightened or molested by swallowing water or, when taken from the water, by gulping air.

A puffer can be made to inflate itself by stroking the skin in the belly region. They are able to puff up very quickly and make themselves larger to discourage enemies which would otherwise attack them. When swollen with air, they bob helplessly, belly up on the surface. When danger is past, they deflate rapidly with humorous belching noises and bubbling at the mouth.

Porcupine fish, close relatives of the puffers, carry their defense a step further: their bodies are covered with long sharp spines. Normally these spines lie flat against the skin, but when the porcupine fish inflates itself, the spines stick straight out in all directions. Fish that try to swallow this little monster never eat again.

Puffers make considerable noise when inflating by grinding their heavy teeth together. Some varieties can inflict a nasty bite if fingers aren't kept away from the mouth when handling.

A puffer's teeth are fused into a beak which is divided at the center. The tooth configuration gives the puffer fish their scientific name *Tetraodontidae*, meaning "four-toothed." These fish use their beaks to crack open such things as small crabs and shells, and scrape food off rocks and coral.

Puffers live in shallow water and are very slow swimmers. They swim by fluttering their pectoral, dorsal and anal fins. They are active little fish that nose about rocks, reefs, and sandy bottoms, mostly in tropical seas.

Although the puffer is a tropical fish, the northern puffer or blowfish are found as far north as New York. On the West Coast of the U.S., the gulf puffer has been known to reach as far north as San Diego in the late summer.

On the East Coast of the U.S., the puffer is cleaned by skinning. The head, skin, and entrails come off inside-out in one package. The remaining edible part

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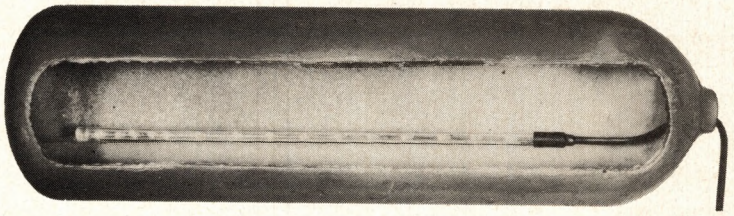

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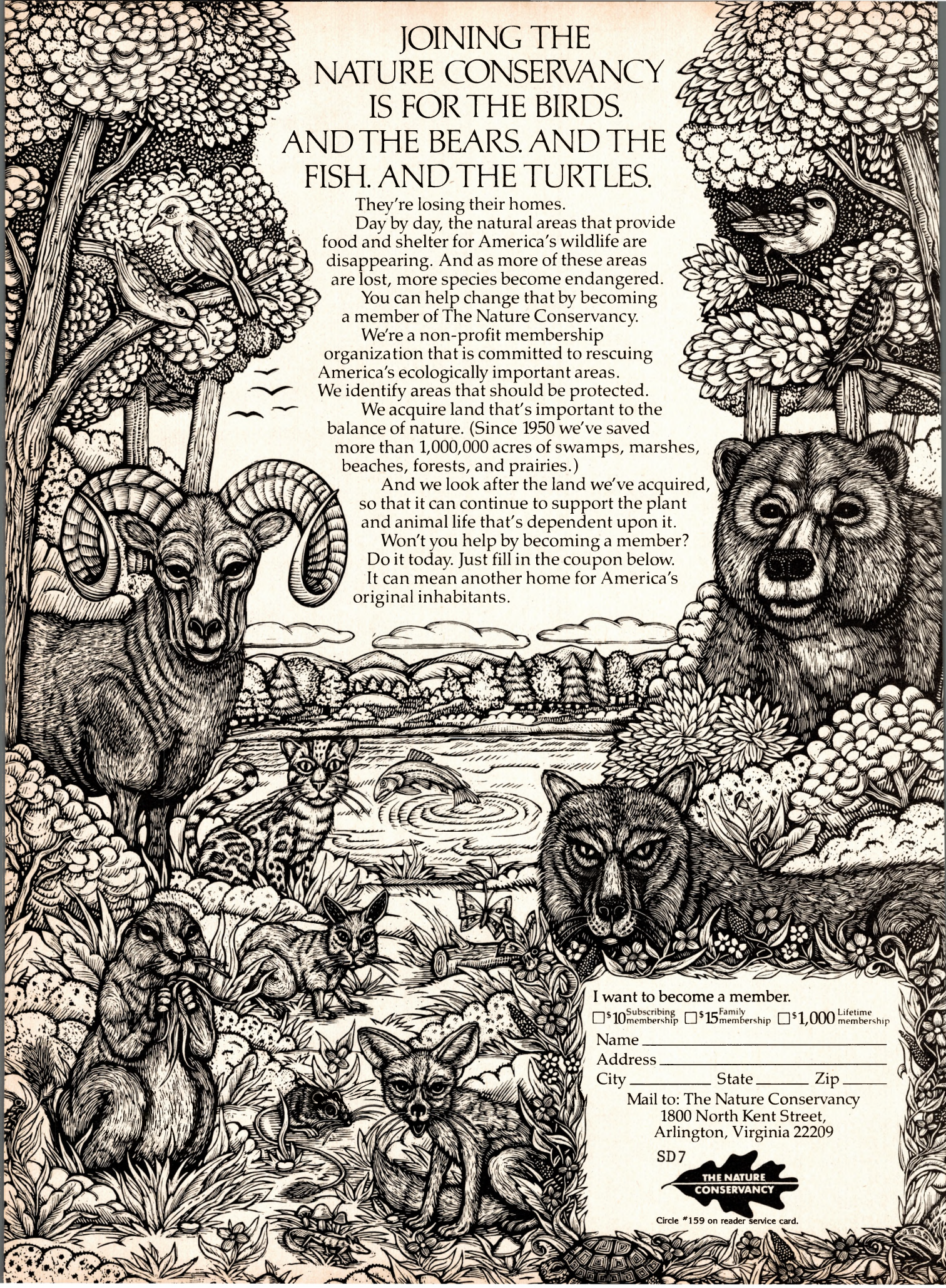

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is a small strip of meat with backbone.

To perform this neat trick first cut deeply through the skin and backbone just behind the head. This will provide an opening for skinning the fish. While holding the backbone, grasp the head and pull the skin completely off the fish. The remaining meat and backbone is ready to cook. The meat can be easily removed from the backbone for fillets.

The following method is used by the specially trained fugu cooks in Japan in preparing fugu chrysanthemum.

Fugu Chrysanthemum

Thoroughly clean, fillet and skin the puffer. Clean puffers very carefully to remove the toxic viscera. Some puffers have very strongly toxic ovaries and liver. Sometimes the skin is toxic. Wrap the meat with clean cloth and refrigerate one day for dehydration. Boil skin one minute and slice into thin strips for decoration. Cut fillet into small triangular shaped pieces. Deform pieces with thumb into concave, flower-shaped petals. Arrange slices on a plate in the form of a chrysanthemum. Season and eat.

Fried Puffer

If you caught or purchased your puffer fish in the north or middle Atlantic Coast of the U.S., or if you would like to play Russian Roulette, then try your luck with the following recipe:

6 puffers, cleaned
1 egg
2 tablespoons water
⅓ cup bread crumbs
¼ cup butter or olive oil

Dip fish in egg beaten with water. Roll in bread crumbs. Fry in butter or olive oil from three to five minutes on each side or until golden brown.

Fugu Sake

Place four or five slices of puffer fish in a cup and pour hot sake over it. Let it soak for several minutes. Eat, drink, enjoy.

Sake-Seasoned Dried Fugu

Soak slices of puffer fish in sweet sake for about an hour. Dry for several days in a refrigerator. Serve.

Hiresake

Cut the dorsal and pectoral fins off several puffers. Rub the fins with salt. Dry fins for one week. Roast fins over a charcoal fire and pour hot sake over them. After several cups of sake you might forget about the fins.

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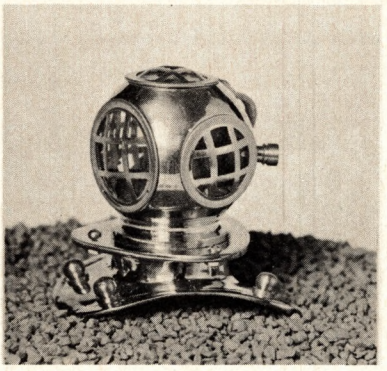

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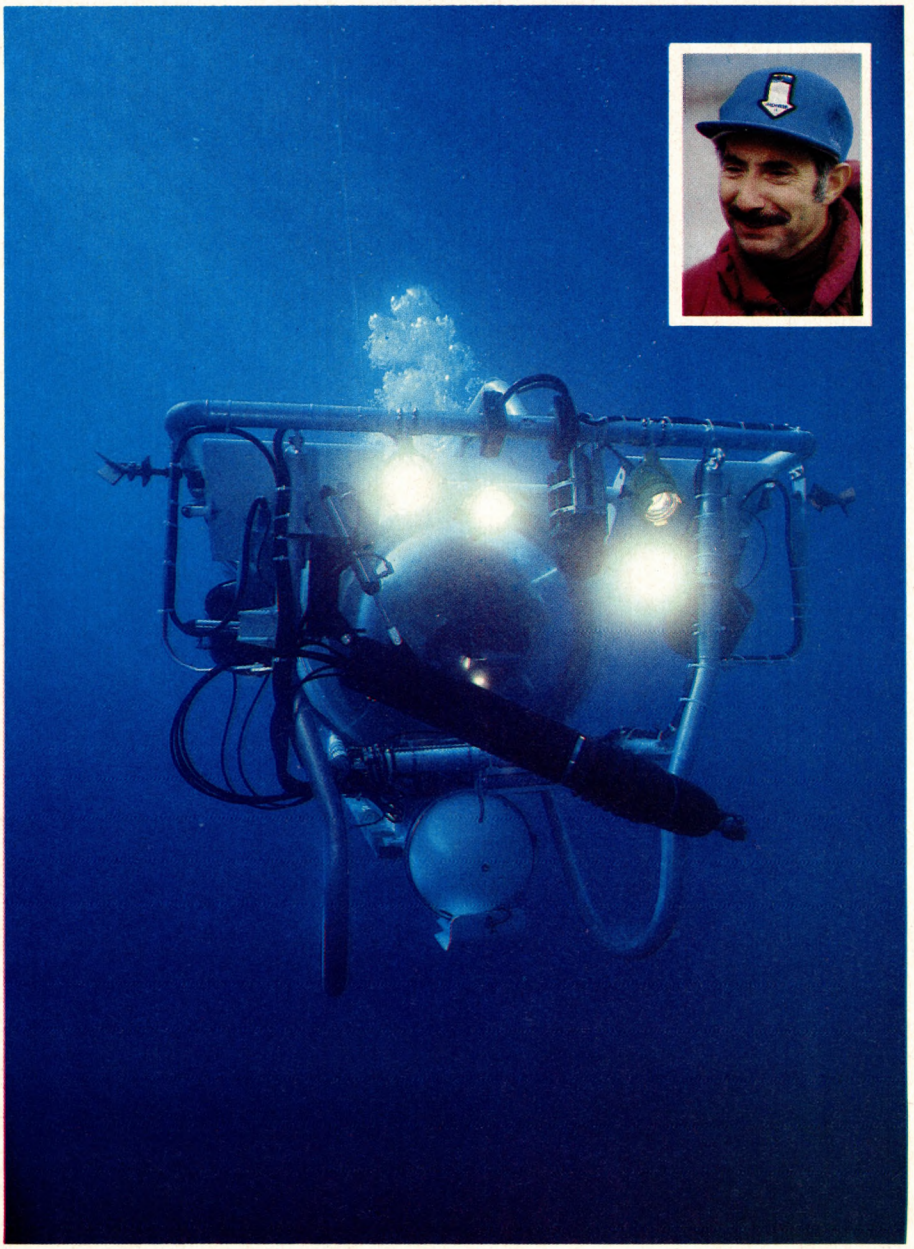
Voyage to the Bottom of Lake Tahoe

With year-round visibility of 120 feet, Tahoe has been an inland diver's dream. Sixteen hundred feet deep, its fragile ecology also interests scientists in submarines.

BY JOHN STEIN
PHOTOGRAPHY BY FLIP NICKLIN

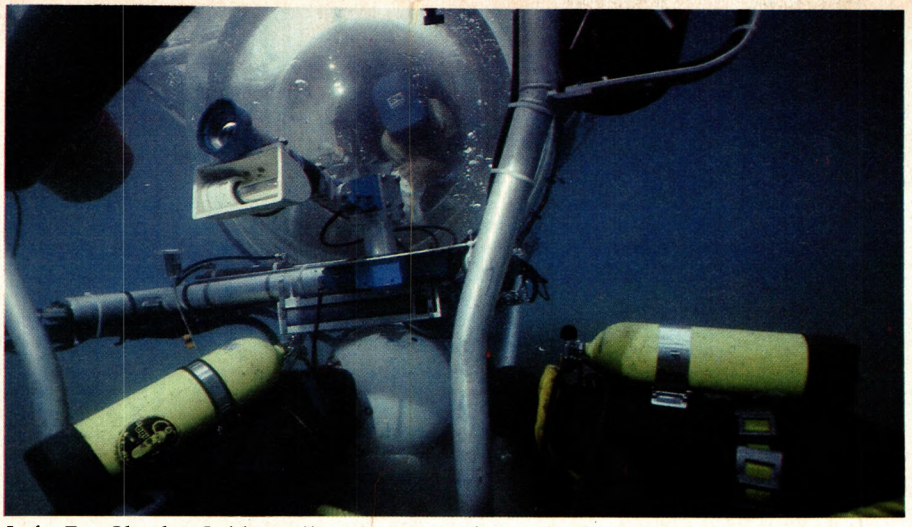


"Greetings from beautiful Lake Tahoe." The salutation stretches back decades, to a time when arriving at the mile-high Sierra Nevada lake was the reward for withstanding an often arduous automobile trip through mountain switchbacks. Greetings usually came from the porch of a lakeside cabin or from a small summer resort hotel at one of two state lines, where California and Nevada meet.

Currently, thousands of tourists and full-time residents swell parts of Tahoe's shoreline. Countless motels, hotels, markets and casinos are all multiplying fruitfully from modern transportation's gift of human mobility. A lot of people aren't bad *per se*, but the alpine lake's growth has run relatively unchecked for what some consider an imprudent length of time. Lake Tahoe, under joint ownership of California and Nevada since the haphazard western land grab of the 19th century, has gracefully borne the brunt of man's intrusions, but it is definitely showing signs of stress.

In the past, one of the most compelling reasons to visit the lake was its incredible clarity. One of only a handful of voluminous alpine lakes in the world, Tahoe's visibility, even today, is tremendous, nearly 120 feet. That's almost as clear as Oregon's pristine Crater Lake, generally accepted as the world's

John Stein is the associate editor of **Cycle** *Magazine and an avid sport diver.*



Left: Dr. Charles Goldman (inset), a specialist in freshwater ecosystems and high-altitude lakes, begins a descent to 1000 feet below Tahoe's choppy surface aboard Pioneer I. *Above: Support divers secure tether lines from a shoreside crane used to deploy and recover the Martech sub.*

clearest large, high-altitude water body, and more viz than you'll get in many Caribbean locales in winter. Tahoe has underwater grasses, cliffs, canyons and interesting inhabitants, but it's undergoing a process of eutrophication – changing from a nutrient-poor to a nutrient-rich lake as a result of nutrients added by man – *bio-pollution*.

Enter Dr. Charles R. Goldman of the University of California, Davis. He is not exactly a newcomer to lakes, or to Tahoe. Goldman first visited the lake in 1958, and has been studying and diving it since then. He is a professor of limnology at UC-Davis, in the department of Environmental Studies, and specializes in high-latitude and high-altitude lakes.

Goldman arrived at Tahoe in October 1979 ready to do what nobody had done before — dive to the bottom of the lake in an electric-powered submersible. Though his rented Martech International oil platform maintenance submarine was not rated to dive as deep as Tahoe's 1600-foot maximum depth, Goldman's plans included dropping nearly 1200 feet, the sub's maximum.

Charles Goldman had been planning a deep dive at the crystal-clear lake for 16 years, but such an operation proved to be extraordinarily expensive. For last fall's expedition, the San Jose (California) *Mercury News* contributed $30,000 for first rights to news, and a Lake Tahoe research group put up an additional $10,000. UC-Davis provided the support vessel, one they regularly use for diving at Tahoe.

Plans included studying specific lake areas in detail, investigating sedimentation, underwater topography and life forms. Dr. Goldman even displayed a curiosity for some mysterious wrecks and scuttled boats from bygone decades. "Actually," explains Goldman, "a big fish story started my interest in taking a submersible into Tahoe." Reports have described monstrous Mackinaw trout lurking in the depths, which speed upward to snare smaller fish from fishermen's lines and then disappear into the depths.

As a limnologist, vegetation and other life forms were of interest to Goldman, and he assembled an itinerary of what to look for. Included were chara moss, a type of aquatic plant, studied for its depth of growth and coverage, and periphytons, algae that have become rapidly widespread since septic tanks began leaching nutrients into the lake. Years ago, Mycesis shrimp were introduced to feed trout, and they consumed much of the lake's natural plankton. Goldman hoped to study the effects these shrimp have had on Tahoe's underwater environment.

Obviously, a submersible would make an ideal observation post, yet the good doctor admitted he had no previous submersible experience. Diving has been part of Goldman's lifestyle since the 1950s, when he took it up while pursuing his PhD at the University of Michigan. Since then he has dived in Arctic waters, and most of the lakes he has studied.

Martech's 17-foot aluminum submarine, the *Pioneer I*, was trucked to Carnelian Bay on Tahoe's north shore, and crew members planned to launch it by crane. The three-man submarine draws approximately six feet of water, and since the lake's surface level had dropped significantly due to recent dry

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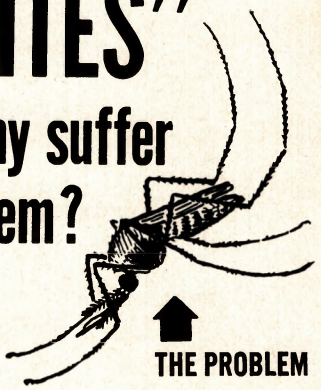

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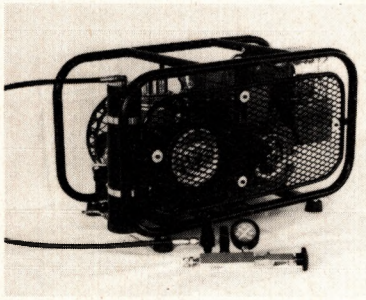

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Sierra winters, it had to be hoisted as far from shore as possible, then towed gently off a sandbar. This process was repeated each of four dive days, since leaving the submarine afloat would make required inspections, maintenance and battery recharging difficult. Not to mention what would happen if the sub were to take on water.

Good visibility was provided through a porthole at the *Pioneer*'s nose and through a transparent bubble in the roof. The submarine had extra equipment too: a mechanical arm could be used to take samples, and four 250-watt floodlamps would provide light.

After each launch the sub was towed to location by the university's support ship, the *John LeConte*. Towing speed was limited to three knots, and underwater the motor-powered craft could do slightly less. The *Pioneer* had a backup electrical system, emergency provisions, an extra air supply, and it was tracked by radar while underwater.

Dr. Goldman participated in five of the nine dives of the adventure, and on the average these dives lasted from one to two hours. A total of twelve people dove, including three pilots.

Monday, October 15 was the first dive, and it took place off Blackwood Creek, on Tahoe's west side. The purpose? To check out equipment and search for a racing hydroplane that sank during a race in 1940. The boat's riding mechanic, Oliver Meek, was on hand to show where he thought the craft had disappeared, but the *Pioneer I* could find no trace of the vessel. Either the hydroplane had shifted position, the sub crew had scrutinized the wrong area, or lake siltation had covered the boat up.

Off Blackwood Creek, Goldman described seeing both fine and heavy sedimentation from lakeside forests; delicate pine needles, large branches and logs. Tahoe's thick basin was logged heavily near the turn of the century — obviously some of the discarded debris remains on the lake floor today.

Many other lost or scuttled vessels remain undisturbed on Tahoe's floor: three large ships were purposefully sunk in 1939 and 1940, and they have not been viewed since. They are the *Meteor*, *Nevada* and *Tahoe*, all public service and luxury cruise vessels.

October 16 saw the submarine at Rubicon Point, also on Tahoe's steep west side, where land drops away to form an incredible underwater cliff face. Monday Goldman dove 857 feet, by far the deepest to that date. During this session the submarine was trailing down the cliff face, using an exposed runner or feeler for contact with the rock, when it became wedged beneath an overhang. A few precious, tedious moments passed before the vessel was successfully manuevered free.

Day three: Wednesday, October 17, brought the deepest dive of the expedition. Goldman and crew submerged to 1000 feet; well beyond the range of natural light. The professor recalls touching the bottom of a large canyon, turning on the floodlamps, looking through the porthole and seeing a Budweiser beer can. During this dive Goldman and the onboard crew did much work collecting research data and taking photographs of "50-pound trout." While events progressed smoothly at 31 atmospheres, weather was not so peaceful on the surface. Four-foot "seas" convinced surface crew members to call the *Pioneer I* up, and the day's diving was completed. Further excitement for the sub passengers came during the tow back to Carnelian Bay: to keep the sub from sinking when its hatch was opened, the *John LeConte* crew simply decided to keep the door closed, dictating a rough ride home for those inside. Apparently, seasickness takes everyone by surprise now and again.

Thursday's dive was delayed by electrical failures, and by the time repairs could have been completed gale-force winds had returned, fanning the lake into an unapproachably rough state. Rather than risk life and equipment, plans were shelved until the following day.

Though the submarine was ready Friday morning, no dives were made because winds were still present. With schedules and plans re-evaluated, a decision was reached to attempt a final dive over the weekend. Unfortunately, the weather did not turn favorable, so the 1979 Tahoe project was wrapped up.

Goldman's favorite *Pioneer I* experiences were relatively simple, in contrast to the project's complexity. Actually visualizing Tahoe's bottom topography, that which had previously been imagined, was Goldman's greatest thrill, and it whetted his appetite to try diving again soon.

Poor weather and time limitations

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caused much of the delays encountered with the *Pioneer I* adventure, and logistically there were two major stumbling blocks. One involved launching the sub without appropriately deep water; the second was that in fresh water, *Pioneer I* was much less buoyant than in a salt solution, so ballast had to be removed from the hull. Even *sans* weight the submarine rode low in the water and required extra care to avoid flooding during boarding operations.

Despite Tahoe's frigid surface water temperature there is a diversity of diving available within safe reach for those without subs. Tops of submarine canyons are within reach, and there are many shallow beaches and rock formations on both sides of the lake, though the gentle slopes are concentrated on the east side. Goldman cautions that when diving in Tahoe you should be aware of your depth and bottom time: since the water is so clear, there's a temptation to dive too deep.

If plans progress satisfactorily, Charles Goldman will be back in Lake Tahoe this summer, heading for lake bottom, and perhaps for some of those gone-but-not-forgotten boats and more monster trout. His plans hinge on obtaining funds, a good submersible and crew, and appropriate weather.

Today, despite the infiltration of man-made nutrients, silt and debris, Lake Tahoe remains amazingly clear. But the area *is* overrun, and continued development remains the lake's biggest threat. If pollution were halted today, Goldman states, many decades would pass before the lake might re-balance itself. The environment will certainly worsen before it gets better, even with progressive care.

Though Dr. Goldman has not reached Tahoe's maximum depth yet, his *Pioneer I* exploits touched off a worldwide reporting frenzy about the lake and its special problems. This, says Goldman, is the greatest benefit of his 1979 research: that Tahoe will be held in regard as an ecosystem that needs extra attention, not just unlimited use.

Without special care, Lake Tahoe could turn into just another overdeveloped resort area; shopping centers, cement and car lots stretching down to the waterline. And that may not be the kind of place you'd like to send greetings from.

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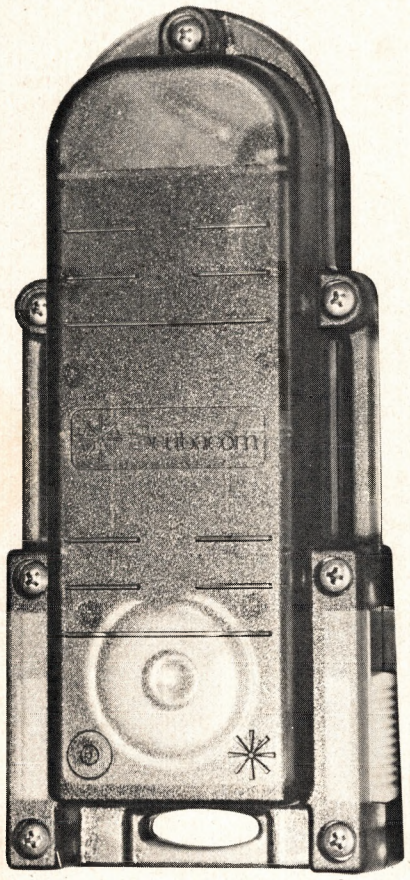

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The Litter Bit That Hurts

Cluttered dive sites are unsightly and the trail of tank valve strips leads straight to divers.

BY LOU FEAD

Surf divers do it on southern California beaches. Fresh-water divers do it along the shores of Lake Michigan. Swift-water divers do it on the bottom of the Colorado River; ice divers do it in North Dakota; and cave divers do it in Florida. Vacationing divers do it from the sunny Caribbean to exotic Micronesia; from frigid Nome to the heated inlets of the Red Sea. It must be fun because divers do it wherever they dive — but, what is *it*? Littering, that's what!

Littering? But divers don't litter. Divers are conservationists. They realize trash hurts the underwater world and, besides, they don't want to dive among beer cans and plastic bags.

But stop and think. Have you ever seen one of those little pieces of dive store tape lying on the ground at a dive site? You know what I'm talking about — those strips the stores put around a tank valve after an air fill.

I've seen them nearly everywhere I dive. Bright bits of plastic tape — blaring out the name, address and phone number of your dive shop — mangled in the sand, dangling from a boat rail, flapping on a sign post. And I have no doubt who put them there.

Did a fisherman jettison the tape while rigging his pole? Did a surfer fling it down before launching into the waves? Could a sunbather possibly have dropped it while spreading out a grassmat? There's no doubt a scuba diver littered after removing the tape from his tank.

OK, divers do litter a bit, but not much, just a few little pieces of tape here and there. Is that so bad?

One diver I know thought so. He was a litter fanatic — not a litterer, but a litter-gitter. Everywhere he went, he picked up those little tapes. Like a string collector, he added each new piece to a ball made of old tapes, and his tape ball grew and grew. But he stopped collecting them — he can't get the sticky ball out of his garage.

Strewing tapes isn't the only littering divers do; it's just the most identifiable. It follows that if a diver carelessly throws his tape on the ground, he's likely to leave other things behind as well. Some divers litter just like normal people with candy wrappers, chip bags, dip tubs, chicken wings, dirty diapers, pop-top rings, and beer/soda/wine bottles and cans. I'd like to think they don't leave as much of this type of junk behind as other beach users do, but they cer-

continued

*Lou Fead is author of **Easy Diver**, an instructor, and has directed several International Conferences on Underwater Education for the National Association of Underwater Instructors.*

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THE ORGANIZATION: The Dominica Project is organized and directed by SEABORNE VENTURES, INC., the largest and most active treasure salvage company in the world with 15 years of field experience in Belize, the Bahamas, Dominican Republic, Honduras, Colombia, Florida and offshore reefs throughout Latin America and the Caribbean.

THE LOCATION: The Project is operating from land bases on the independent island nation of Dominica, northernmost of the Windward Islands. Located between Martinique and Guadeloupe, Dominica is the least commercialized and the most ruggedly beautiful of any major Caribbean island. Although only 29 miles long and half as wide, Dominica has 100 miles of white and black sand beaches surrounded by crystalline waters that remain at 82 degrees year round. The interior of the island is dominated by peaks that rise to 4,700 feet and are covered by verdant, lush tropical rain forests harboring some of the most exotic flowers and spectacular waterfalls anywhere.

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THE REQUIREMENTS: Active participants must meet all of the following qualifications: (1) An ability to adapt to a tropical climate, local diet, and a native Caribbean culture, excellent physical condition to endure long hours of surface and underwater work, and a willingness to work with others toward a common goal. (2) Substantial experience in SCUBA and/or hooka diving and practical skill in any of the following fields: mechanics, seamanship, electronics, marine salvage, photography, writing, archaelogy, art, or related fields necessary to make the Project entirely self-dependent. (3) A minimum $5,000 investment in the Dominica Project which guarantees room and board for a period of one year, round trip air transportation from Miami to Dominica, and a percentage of all profits (sale of recoveries, media earnings, exhibits, tours, etc.) realized from the Project.

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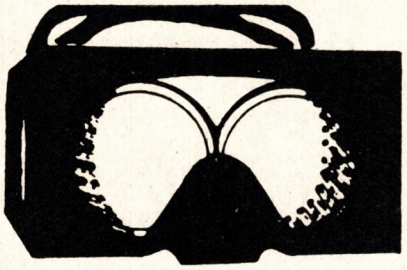

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tainly do leave some different kinds.

For instance, have you ever seen a broken mask strap, a snorkel keeper, or an empty fin discarded on a beach? I'll give you one guess who left it behind. Sometimes when a diver breaks out his fresh frog flippers, he becomes so engrossed with the double-ducted, venturi-boosted, jet-assisted, rocket-propelled, rib-stabilized futuristic construction, he forgets the box immediately. If he throws the box on the ground, it's litter. If he makes it to a trash can, it's controlled waste.

Of course, some divers don't discard their equipment boxes right away. They use them as gear bags until dive site moisture softens the containers into soggy shreds and then kick them out of the car trunk. The sloppy mess may be biodegradable, but it's really litter unless controlled by a waste receptacle.

Other equipment packaging can be even more harmful to the environment, and even more unsightly when left uncontrolled. The plastic bags and boxes carrying O-rings, small parts, and gauges/meters can frustrate nature's biodegrading machinery very badly, and for a long time.

Diving photographers have a distinctive brand of non-organic trash. Plastic film containers, batteries and flash bulbs aren't peculiar enough to draw attention to the littering photographer on land, but in the water they do the job quite well. A flash bulb certainly does not grow underwater naturally.

Litter under water is not only ugly, but dangerous to *all* animals that live/play there and should be removed regardless of who dropped it. Snorkel holders, pop-top rings, plastic bags and sheets, and monofilament fishing line, if left down long, tend to create havoc with waterborne life, including divers.

I once saw a lovely senorita fish swim by wearing a cheap plastic snorkel-holder around her body; like a tight ring on a fat finger, the holder made her not long for this world. Pop-top rings have done the same, in addition to interfering fatally with the digestion and respiration processes of many an animal. Plastic bags, sandwich bags, and Saran Wrap can also interfere thusly, even when animals as large as whales suck them in, according to a veterinarian's report.

And then there's monofilament line. Have you ever been caught in a web of line and had to be cut free by your

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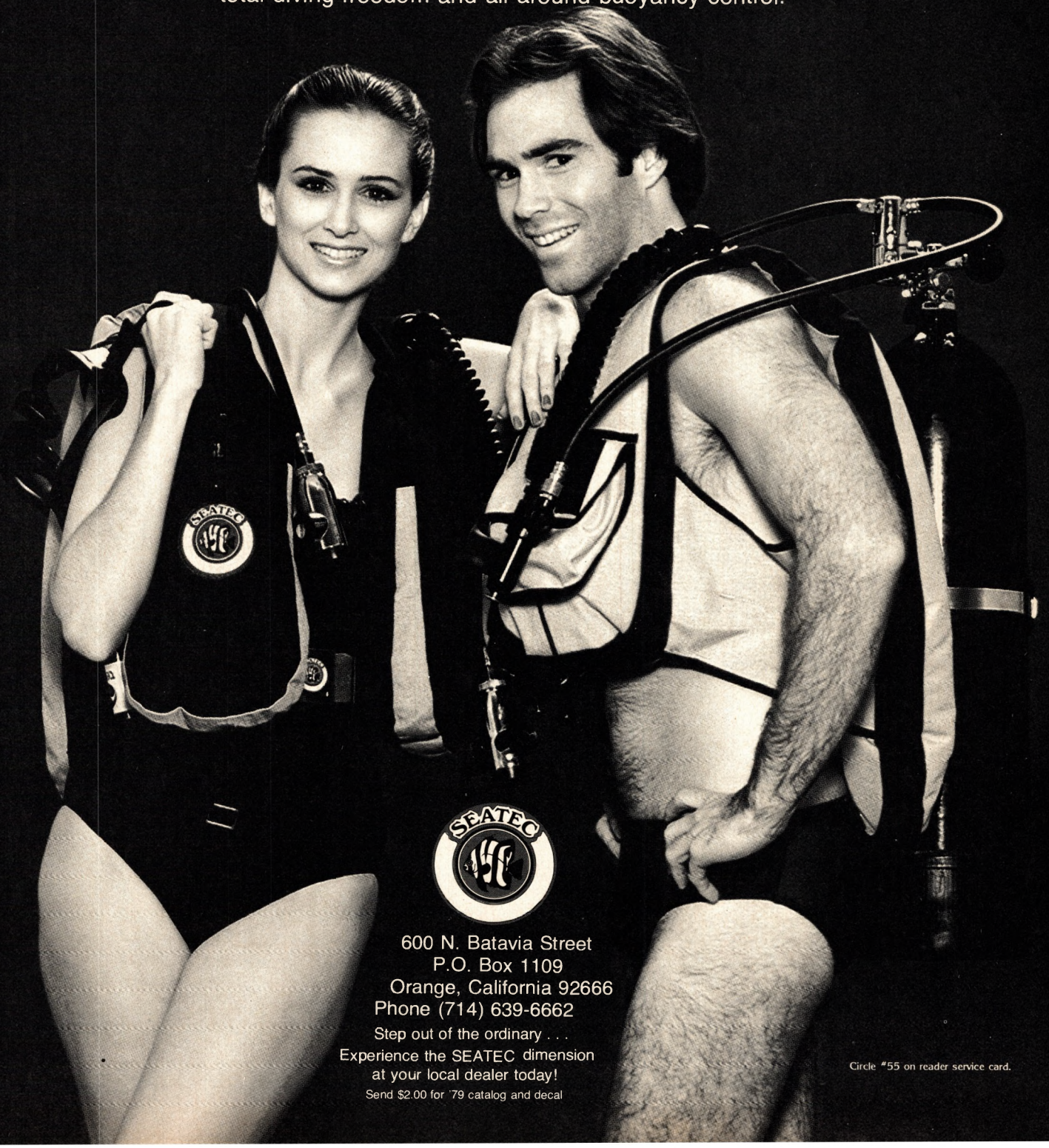

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buddy? Or slid your hand down a strand to get it away and rammed a hook into your finger? Don't — neither is fun!

Divers aren't the only targets for line and hooks. Over the years, I have freed a catfish in Colorado, a mud puppy in Missouri, and a cormorant in California from lives of dragging ten feet of monofilament around by the hooks in their mouths. The only way such gruesome situations can be avoided is by eliminating the cause—"trash."

Solving the problem is quite simple. Just like solving diving emergencies, *prevention is the best cure*! Don't litter, then we won't have to un-litter. Eliminating littering and un-littering saves the energy of both actions, and that appeals to me, the Easy Diver.

Of course, some divers, and other people, don't care about littering regardless of what we say. They litter, and they make it necessary for others like us to "git" litter. Happily, they also make it possible for us gitters to get a bonus now and then. My buddy team has found a waterproof light meter off St. Croix in the Virgin Islands, a fine fishing rod from Upper Bull Shoals Lake in Missouri, and several times off various coasts we've picked up goodie bags, knives, and the like. And we never considered these items to be litter.

Other "litter," like discarded drink containers, bottles and cans, may also have monetary value. Deposit bottles can be exchanged at a local grocery for five to ten cents each; and you can exchange the "no deposit-no return" kind at a local trash barrel for peace of mind.

Aluminum cans have the best exchange value, although it varies with location. In San Diego, I was paid 17 cents a pound and there are about 17 cans per pound. The steel and cardboard cans on the other hand are only as valuable as the "no deposit-no return" bottles, and belong in the same trash can.

Since I started collecting recyclable aluminum products several years ago, my diving cost has gone down markedly. My diving team usually buys several packages of bait for feeding animals each weekend—at a buck a bag. By collecting the waste aluminum we generated in replenishing our body fluids after a dive, we managed to partially offset that cost.

Eager to cover the entire cost, and maybe turn a profit, we began collecting aluminum in earnest. We prowled neighborhood alleys and dumpsters, and scouted through waterfront trash cans whenever poor conditions prevented our diving. We raided beach blanket bingo parties. We even replenished our bodily fluids more than necessary, just to generate more cans.

It's true that one man's litter is another's treasure, like the light meter and cans. But some manmade litter is a treasure for the denizens of the deep

For instance, bottles that dive and don't re-surface are structurally sound habitats for certain creatures. It takes time for a beer bottle to be integrated into a submerged community, but once acclimated by inactivity, it is occupied by many different organisms. Minute encrusting animals anchor to its hard surface. An opaque bottle's narrow entrance and solid walls make a perfect den for an octopus. Worms, corals, and even fish like the sarcastic fringehead build their lives on and in sunken bottles, cans, pipes, cars, boxes, bicycles, chairs, chains and anything solid that stays down for some time.

This creates something of a conflict of interest. Though it may be a "natural" habitat for many forms of life, an old can under water looks like trash to a diver in a clean-up campaign. Anti-litter efforts like SLOBB (Stop Littering Our Beaches and Bays) in San Diego have innocently destroyed many submerged homes in the guise of cleaning up mankind's trash. Seeing a pile of beached "litter" coming alive with struggling octopuses, fish, crabs, and even worms proves that.

Seeing so many animals die in the name of trash collecting is sickening indeed! Therefore, those who cherish marine life do their litter-gitting very carefully. They don't pick up any trash, unless it is free of any growth or animals. If an animal needs the trash, man doesn't. So you lose a few cents of deposit money.

But back to the litter that motivated this article — tank valve tapes. It's a shame that collecting them isn't remunerative, or I would be rich. Collecting does have rewards though, and they may be worth more than money.

First, removing the tape from its littered location reduces the insult of trash to your eyes, and restores the area more to its natural appearance.

Second, from a dive store's point of view, it reduces bad publicity. The store puts its name on the tape for beneficial advertising, not as an identification label for all the trash that's around.

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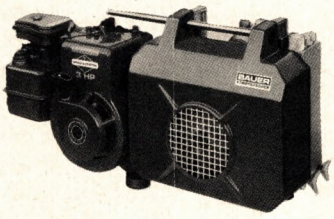

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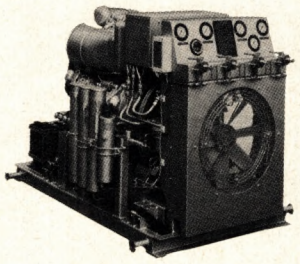

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Third, when the tape is littered, its presence is prima facie evidence to the rest of the world that a diver did *all* the littering in sight. A diver threw the tape down; ergo, he must have dumped all the other junk too. The bottles, cans, ciggiebutts, papers, torn shirts, and wornout sneakers are his too. The tape says so.

All that littering says divers are not good for community beaches. It follows then that divers should be eliminated from the beaches to protect them. Sadly, that has happened in several places, using arguments very close to this.

So, littering can literally cost us our diving. To avoid the repercussions that can begin with littered dive-store tapes, here are two simple actions you, the diver, can take.

First, *do not litter your own tape*. One way of doing that is not to use tape, and that is what I now do. I have a rubber cover over my tank valve taking the tape's place. It is hooked to my valve by a cord so it can't be thrown down as litter. These rubber or plastic covers are available at most dive stores.

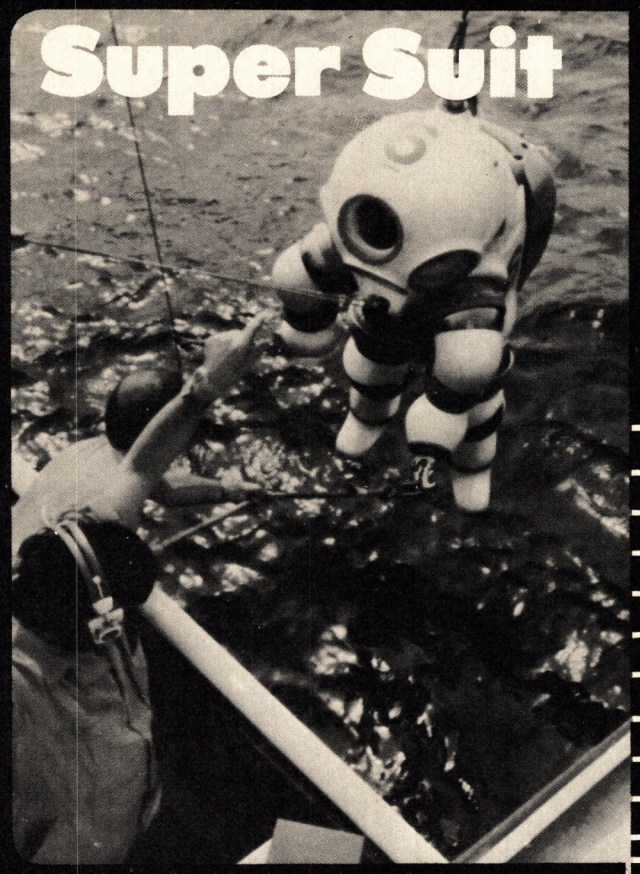
Another solution is to properly dispose of the tape after use — put it in a trash receptacle. Sticking it on your tank is no good; it washes off. Sticking it on a boat or building is no good either. If it doesn't fall off, it will peel the paint off. Putting it directly into a trash can is very good. But, if one isn't nearby, putting it in your dive bag, pocket or purse is almost as good.

The second action is *to collect other divers' tapes*, everywhere you go. (You, too, can fill your garage with a giant, sticky ball!)

Consider what we've talked about as you start your next dive. If you can avoid littering the tape, you're on your way to not littering at all. And, if you spend the first two minutes at any dive site running around gathering up littered tapes, you'll help nature's restoration process considerably.

You may appear to be some kind of nut to your buddies, but maybe your abstinence from littering, and your fanaticism about litter-gitting will spread to them, your friends, acquaintances, and even passersby — so we can all stop littering. Perhaps we could, with time, return our natural resources to an uncluttered condition for the enjoyment of all.

Please don't stick your tank tape on my world!



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Movies must be 8mm, super 8 or 16mm with or without sound, 15 minutes or less. Entrant's name and address must appear on the container and the film leader.
All possible care will be exercised, but no responsibility will be assumed by *Sport Diver* Magazine or Ziff-Davis Publishing Company for the loss or damage of entries.
Judging shall be done by the photo competition committee using a basic point system on technique, composition, color, quality and story. Decision of committee is final.
Submission of entry acknowledges right of *Sport Diver* Magazine to publish photographs entered for any purpose.

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Loran-C: Faultless Navigation

Accurate to within 50 feet, a Long-Range Navigation set can be a skipper's best friend. But watch out for your wallet.

BY LOWELL P. THOMAS
ILLUSTRATIONS BY
EZIO MATTASSI

The Loran-C unit hummed softly as its readout changed with our position. We hadn't seen land for four hours and as we ran down our bearing the skipper turned to me and said, "This Loran is going to put us 50 feet from the wreck."

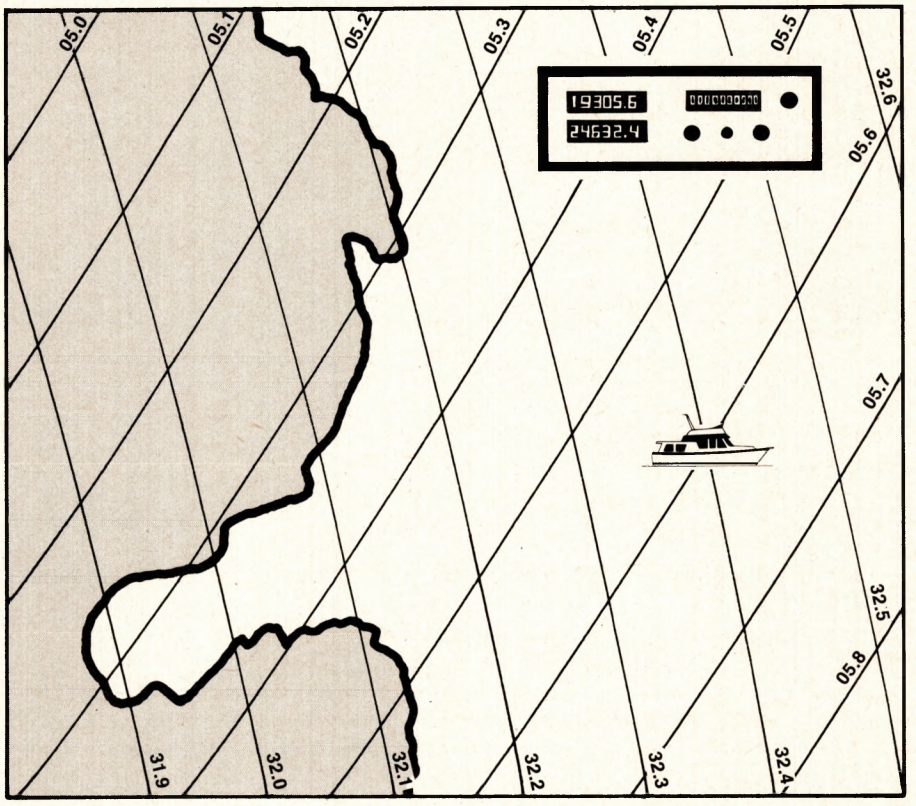
Maybe, but I had to be convinced.

Suddenly the set buzzed and the word "Arrive" flashed on the screen. The skipper throttled back and put us in reverse. "Damn," he said, "almost ran past it." My mouth dropped open as he pointed over the side to the long, dark shape visible 50 feet down in the clear water. It was the wreck. The skipper had found it three months before and by taking a Loran-C bearing on it, he'd put us right on the money.

This kind of precision navigation and homing onto wrecks and reefs is possible with Loran-C. And a Loran in operation aboard a research vessel is impressive. A good sextant in the hands of a good navigator, who gets a good sight, might place him within a mile of his actual position; Loran can put you within 50 to 100 feet, every time.

If this sounds convincing, take a minute before you rush out and buy a set to ask yourself some hard questions. The first one involves the thickness of your wallet. It had better be stuffed with the green and not unpaid bills. Loran isn't cheap. To put in business with a modest set will run you from $1500 to $2000. On a dark and stormy night, with lightning flashing all around, it can guide you safely past a deadly ledge or through a narrow pass. Saving your skin is worth at least two bills.

Loran, (an acronym for Long-Range Navigation), was developed during World War II at the Massachusetts Institute of Technology. By the end of the war, 90 transmitting stations were sending signals to more than 75,000 receivers aboard various ships and airplanes. Present-day Loran-C and its forefather, Loran-A, operate on the principle that the time it takes for a radio signal to travel over a given distance gives you the distance. Imagine a pair of Loran



The illustration above shows how Loran-C is used with a chart to determine position. The receiver tracks the signals of at least two Loran transmitting stations and computes the time each signal takes to reach the vessel. Both time differences (in microseconds) are displayed as six-digit lines of position, or LOPs. The point at which these LOPs intersect on the chart is the vessel's position.

Dr. Lowell P. Thomas is a professor of marine science at the Rosenstiel School, University of Miami. Besides scientific journals, his work has appeared in ***National Fisherman, Mariner's Catalog, Sailor's Gazette*** *and* ***Sea Frontiers****.*

Loran-C coverage is now effective within 50 miles of the U.S. Atlantic, Pacific and Gulf coasts, including the Great Lakes. However, depending on atmospheric conditions and the efficiency of the receiver, somewhat less accurate positions can be obtained up to 800 miles offshore. Loran-C is also available in Hawaii and in portions of the western Pacific, the North Atlantic and the Mediterranean.

stations broadcasting simultaneous signals. The delay between the arrival of the two signals represents the difference in distance to the ship of the two stations. Suppose the delay in arrival of the second signal places the first station 20 miles closer to the ship than the second one. The first station could be 20 miles away and the second 40 miles, or the first could be 200 miles away and the second 220. In fact the ship lies on a line passing through those two time differences and every other 20 mile difference between the first and the second station, called the line of position or LOP. Now your Loran will pick up other pairs of stations and record the difference between the arrival of their signals too. This will give you more lines of position, all of which your ship rests upon. These lines all cross one another at the point of your position.

But that's not the whole story. There are a few things which can mess up your set. One of the biggest curses to Loran-C users is interference. Loran-C stations broadcast low frequency signals, right at 100 kHz. This frequency was chosen because signals travel better at low frequency. It enables Loran to cover a lot of ground. Unfortunately, Loran-C chains (one master station and its secondary stations), aren't the only producers of low frequency signals. Nearby radio stations may transmit signals close to the 100 kHz. Low frequency noise is produced by the electrical equipment aboard your ship. A Loran set doesn't know the difference between a bona fide Loran signal and a nearly identical signal from your bilge pump. Such outside signals can block or interfere with the signals you need for a proper fix. Fortunately, this shipboard noise can be controlled by installing inexpensive filters in the electrical system.

Another problem for Loran users is skywave propagation. The Loran signals your set uses are ground waves which follow the curve of the earth. Loran transmitters also produce skywaves which bounce off the ionosphere. These

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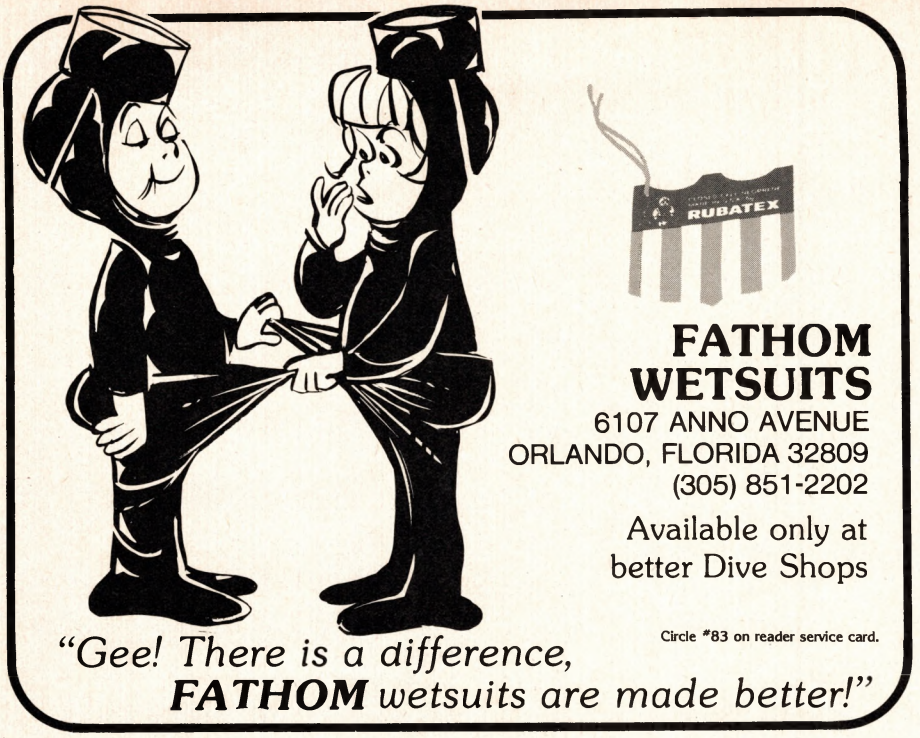
are particularly easy to pick up out near the limit of Loran reception (1200 miles), and at night, when they bounce around like ping-pong balls. If you have a general idea of your location, skywaves will give you such odd readings you'll realize what's going on. Also, your set is built to screen out skywaves or warn you if it is having difficulty because of skywaves. Switching to another Loran chain can cure this problem unless you are out at the limit of Loran reception.

When atmospheric conditions are bad, during thunderstorms for example, Loran signals may be completely lost in the clutter. How well your set will acquire signals in a storm with a powerful shoreside radio station broadcasting near 100 kHz, and all your electrical equipment humming may be determined by how much you've spent on your set. Generally, the bigger, more expensive sets acquire weaker signals at a greater distance than cheaper sets. But even the least expensive sets are remarkably accurate.

The least expensive sets list for $1500 to $2000. The receiver is about the size of a portable typewriter and comes with wiring for grounds and antenna. You may need to buy a standard fiberglass CB antenna, but a preamplifier will be built into the system. A mounting plate and thick instruction booklet finish off the package.

Basic operation is easy. By punching buttons or turning a dial you enter the GRI, the number tuning you in to the Loran chain serving your area. After a short period, the machine will display several time differences (TDs). These numbers represent lines of position on a Loran-C chart. You will probably get four or more TDs, two of which will give you a good fix. Lines of position crossing at right angles are the best. Often one of the pairs of LOPs will be too close to parallel to give a good fix and must be discarded. LOPs can often be stored for retrieval and other functions can be handled, depending on what kind of system you've bought.

Your set will have various warning lights. A signal to noise ratio, SNR, indicator tells you how strong the Loran signal is relative to noise. Some sets have manually operated notch filters to tune out noise as it appears. Other, less expensive sets, only have notch filters built in. They can be adjusted by service personnel to suit special conditions, but otherwise are pre-set. If the signal to



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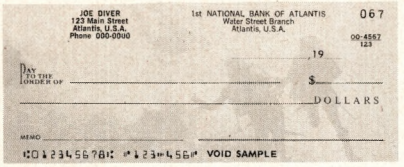

PLEASE FOLLOW THESE INSTRUCTIONS CAREFULLY!!!

Write out your check and include a deposit slip from the same account. We must have both check and deposit to furnish the data we need to make your checks compatible with your bank's computer, and Amer. Bank. Ass'n. specs. On gift orders, send your check and mark his/her check VOID. If you prefer to pay with Master Charge or Visa, enclose your check and deposit slip marked VOID.

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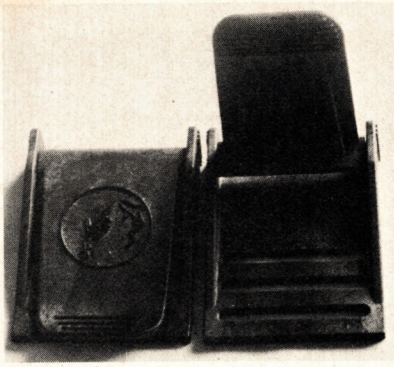

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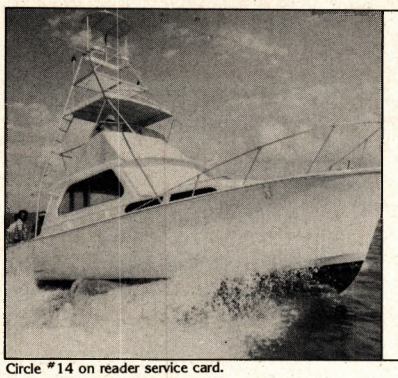
noise ratio indicates too much noise, you select an alternative secondary station or tune out the noise.

The more expensive sets have more options and perform better under bad conditions or near Loran-C range limits. But you pay for this: from $3000 to $7000. In some Loran sets the coordinates of the various Loran transmitting stations are stored in the set in such a way that a digital computer can compute the receiver's latitude and longitude based on the TD it receives. Instead of getting a pair of Loran LOPs you get a readout of the actual location. There are even sets which give you a readout of latitude and longitude of your destination, range and bearing to that destination, course error and estimated time of arrival, speed and course made good and what kind of drift you are experiencing. The unit will then signal when the ship is 1000 feet from the destination.

When it comes to deciding which set to buy, shop around. Talk to everyone and his brother first, then go to the salesmen. Armed with information gleaned from all the fishermen and divers in your area, you can ask some penetrating questions. I wouldn't buy a set I hadn't seen in operation, preferably on ship-board. You may hear some bad reports about particular sets, but take this with a grain of salt. A lot depends on installation and suppression of electrical interference from the boat itself. Even the best set won't perform well in the hands of the wrong person.

The U.S. Coast Guard publishes a paperback book called *Loran-C User Handbook,* Coast Guard Publication 462. Write or call for a free copy. The book gives some recommendations as to what you should look for in a good set. But even these may not be entirely warranted. A lot of technological water has gone over the dam since it was published in 1974. I suspect some of their recommendations may refer to faults since corrected. Don't worry about Loran-C becoming obsolete. It is *the* official government sponsored navigation system for the U.S. Coastal Zone. Loran-C will be around for a long time.

One final word regarding Loran. Don't let it make you lazy. If your set dies, you are right back where you were, with cross bearings, running bearings, noon sights, RDF bearings and soundings. The navigator's arts are not limited to reading a Loran display—even in the 1980s.



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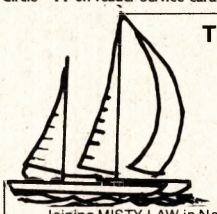

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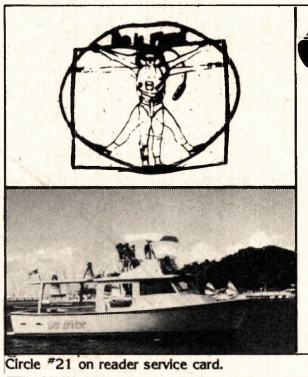

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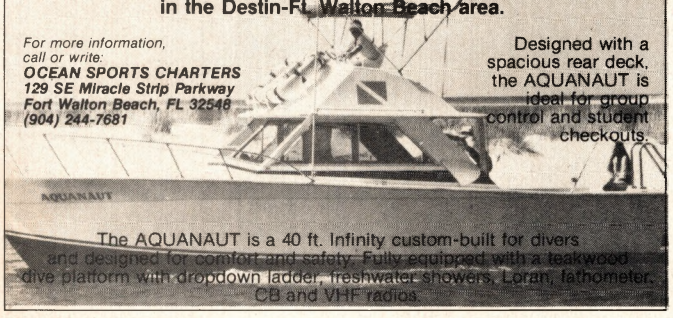
Designed with a spacious rear deck, the AQUANAUT is ideal for group control and student checkouts.



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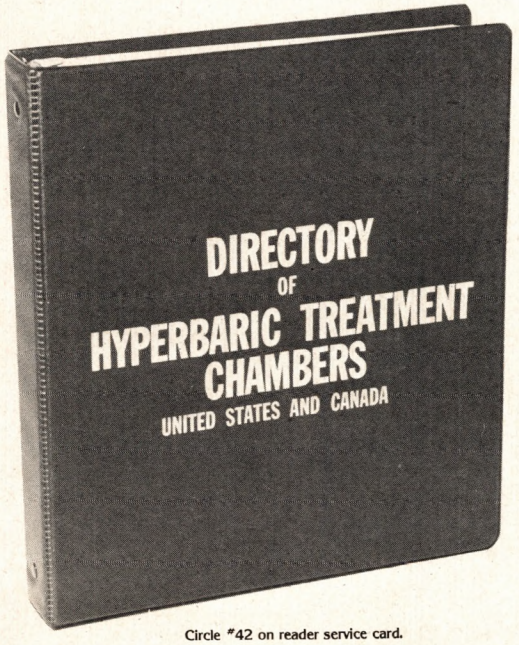

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THIS BOOK COULD SAVE YOUR LIFE!

Sport diving should always be conducted within no decompression limits, however, fatal air embolism and decompression sickness is always a tragic possibility.
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4 TO 6 WEEKS DELIVERY

PRO DIVE STORE DIRECTORY

The Pro Dive Stores below are listed by state, then alphabetically by cities and store name within each city. To advertise your professional services in the directory, send $110 (6 issues) check or money order, with listing information to Pro Dive Store Directory c/o Patti Leshow, 444 Brickell Avenue, Suite 250, Miami, Florida 33131. Prepayment will expedite materials and assure your listing. Tell divers where you are, what you offer, and that you want to do business with them—list your facilities in the Pro Dive Store Directory.

ALASKA

Alaska Aquatic Dive Center
NASDS Inst.-Full Svc. Scubapro Shop-Air-Rentals-2 man chamber-Hydro & Tumble-Alaskan rep for Seaform pile restoration. 503 Water St. Ketchikan, Alaska 99901 (907) 225-5020, 225-DEEP

South Central Diving
Your full service Alaskan Pro Shop. Charter trips-Air fills-sales-SSI Instruction-Service-Rentals-Repairs. Commercial work insured & bonded. Cold water specialists. P.O. Box 1531, Valdez, Alaska 99686 (907) 835-2585.

ARIZONA

Aqua-Sports, Inc
Scubapro dealer and full services. Same owners for 25 years (Boris and Rose). NASDS/NAUI/PADI Instr. U/W Photo & trips all over the world. 4230 E. Indian School Rd., Phoenix, Arizona. (602) 955-4120

Arizona Divers Supply, Inc.
YMCA Basic & Advanced scuba classes offered yr. round. Training includes safety techniques, first aid & U/W navigation provided. U/W Photo course available. Int'l travel for groups. 2348 N. 7th St., Phoenix, AZ 85006. (602) 253-6622.

Scuba Sciences, Inc.
Arizona's most active dive center-NASDS. Indoor heated pool. 8502 N. Black Canyon Hwy., PHX, AZ 85021; (602) 995-5926 or (602) 946-1620 1833 N. Scottsdale Rd., Temp, AZ 85281

ARKANSAS

Scuba Hut-Sportsco
Custom Screening & Transfers-Shirts-Instruction-Air-Rental-Boats 1115 S. Hwy. 71, Springdale, AR 72764 (501) 751-0636

CALIFORNIA

Scuba Schools of Anaheim/Long Beach
Classes-Equipment-Sales-Repair-Rental. 1640 W. Lincoln, Anaheim 92801, (714) 956-5540; 4740 P/C Hwy., Long Beach 90804, (213) 433-6765

Aqua Ventures Diving School
PADI 5 Star training facility. All major brands. Complete professional in-house repair. Tour Channel Islands. Closed Sun. 3000 psi-Sales-Rentals-U/W Photography. 2172 Pickwick Drive, Camarillo, CA 93010 (805) 484-1594

Sea to Sea Scuba School
NAUI-PADI-YMCA Instruction, all levels-Sales-Repairs-Rentals-Travel Pkgs.-Air 10950 S. Mt. Vernon, Colton, CA 92324 (714) 825-2502

Divers Corner
U/W Photography-Air-Sales-Service-Rentals. Individual or group trips to Mexico, Southern California, Caribbean. 11200 Old River Rd., Downey, CA 90241; (213) 927-1417.

Ocean Sports, Ltd.
NAUI-PADI-Sales-Rentals-Repairs-3000 psi-Air-Trips. 16446 Bolsa Chica (at Heil St.), Huntington Beach, CA 92649; (714) 840-4840

Laguna Sea Sports
925 N. Coast Hwy., Laguna Beach (714) 494-6965; 1951 Newport Blvd., Costa Mesa (714) 645-5820; 7066 Van Nuys Blvd., Van Nuys (213) 787-7066; 18503 Hawthorne Blvd., Torrance (213) 542-8609; 3335 Motor Ave., W. Los Angeles (213) 559-7771

New England Divers, Inc.
Open 7 Days-NAUI-PADI Certification 11830 W. Pico, Los Angeles, CA (213) 477-5021; 3860 Rosecrans, San Diego, CA (714) 298-0531; 8363 Center Dr., La Mesa, CA (714) 462-4570

Divers Down—San Fernando Valley
Complete Instruction-Htd. Pool-Dive Trips-Open Water Certification-Equip. Sales-Rentals 6742 Reseda Blvd., Reseda CA 91335 (213) 342-1212

Scuba Duba Dive
12538 Ventura Blvd., Studio City, CA 91604 (213) 761-7833; 7126 Reseda Blvd., Reseda, CA 91335 (213) 881-4545

Wallin Dive Store
U/W Photo Specialists-Instruction-Rentals-Air-Repairs-Travel-Marine Art-Books-Jewelry 1656/58 El Camino Real, San Carlos, CA 94070 (415) 592-7606

Sea ME
Repair-Alterations, Custom Suits, Accessories Seals, Personalized Designs. We specialize in Manufacturing & Designing of any Neoprene product. 4349 Home Ave., San Diego, CA 92105. (714) 264-4932

Bamboo Reef
Sales-Service-Air-Instruction 584 4th St., San Francisco, (415) 362-6694; 1111 University Ave., Berkley, (415) 548-7560; 1956 W. San Carlos, San Jose, (408) 275-1696; 614 Lighthouse Ave., Monterey, (408) 372-1685

New England Divers, Inc.
110 Embarcadero, San Francisco, CA 94111 (415) 434-3614

MR. KONA accommodations for Divers
Reasonable rates-Free cars. Reservations requested. 330 Viscaino Way, San Jose, CA 95119 (408) 225-3658

The Diving Locker
1020 Grand Ave., San Diego, CA (714) 272-1120. 1148 Delevan Dr., San Diego, CA (714) 231-8331. 348 E. Grand Ave., Escondido, CA (714) 746-8980. 405 N. Hwy. 101, Solana Bch, (714) 755-6822

COLORADO

Odyssey Diving Center
2680 S. Havana, Aurora, CO 80014, Alan Cunningham, (303) 751-4991

CONNECTICUT

Orbit Marine Sports Center
NAUI-PADI Instruction-Sales-Rentals-Air Trips-Hydro-Visual Insp. 3273 Fairfield Ave., Bridgeport, CT 06605; (203) 333-DIVE

The Diving Bell
Full service, professional dive store. U/W photo gear. All levels scuba instruc.-travel-open all year. Rt. 7, Brookfield, CT 06804; (203) 775-3573

Aqua Sports, Inc.
Air Station-Instruction-Service-Tank Testing & Cleaning-Salvage-Repairs. Victor G. Worst & Phyllis C. Tetrault, Rt. 12 & Long Cove Rd., Gales Ferry, CT 06335. (203) 464-7878

Innerspace Diving Supply Co., Inc.
Air-Sales-Rentals-All services-Dive Club-Dive trips to Rockport, Mass., Maine and Rhode Island. U/W photography instruction. Certified instruction in all levels-NAUI/PADI/YMCA. 598 Center St., Manchester, CT/PADI 5 Star. (203) 646-2352

Jack's Dive Center
Sales-Service-Instruction-Rentals-5000 psi Air-Trips-Photography & Commercial Equip-AGA Divator. Rt. 10, Plainville, CT 06062 (203) 747-3170

Ski & Scuba Shoppe
Full service dive shop. U/W photo specialists-USCG charter boat-Sales-Service-Rentals-Instruction. Stratford Marina, Foot of Broad St., Stratford, CT 06497; (203) 377-6969

FLORIDA

Underseas Inc.
Key's largest pro dive shop-Daily half & full day reef trips to Looe Key-Charters to Cay Sal Bank, BA-Sales-Repairs-Rentals-All major credit cards. P.O. Box 319, MM 31, Big Pine Key, FL 33043 (305) 872-2700; 872-9555

Nautilus Dive, Surf & Ski
Open 7 days a week. Rentals-Air-Instruction-Trips-Repairs. 877 E. Palmetto Park Rd., Boca Raton, FL 33432, (305) 368-0555. 2700 E. Atlantic Blvd., Pompano Bch, FL 33062, (305) 943-DIVE

Gulfview Divers Headquarters
Air-Rentals-Sales-Scuba Course-Pool on premises-Dive trips-PADI Inst. 101 Bridge St. Bradenton Beach, FL 33510. (813) 778-3735

Mileo Photo Supply (305) 446-0855
2105 Ponce de Leon Blvd. Coral Gables, FL 33134. Nikonos-Subsea-Ikelite-Sunpak Marine-Pentax. Dealer inquiries invited. FL WATS (800) 432-2384. Your U/W Photo Equipment Specialist.

Charlotte Diver
Sales-Service-Rentals-Lessons-Air
861 S.E. Tamiami Trail, Charlotte Harbor, FL 33950. (813) 629-2722

Aquatic Gateway
Full line diving center-Open 7 days-Free area reef map. 15 N. Federal Hwy., Pompano Bch, FL 33062, (305) 782-5768. 10115 W. Sample Rd., Coral Springs, FL 33065, (305) 753-4210

Manatee Headquarters
Talley's Pro Dive, CMAS, PADI, IDEA-Tours-Boat Rentals-Equip. Repair-Dive shop-Instructor rates. 251 NW 3 St., Crystal River, Fl 32629. (904) 795-2776

Port Paradise Resort
Waterfront resort w/hotel accommodations, restaurant, lounge. Come dive with the manatees! Marina dive shop offering PADI instr., basic, openwater and advanced. Weekly courses. P.O. Box 516, Crystal River, FL (904) 795-7437

Herb's Dive Shop
Reef Trips-Scuba Tours
2434 S. Atlantic Ave., Daytona Bch., FL 32018 (904) 253-7221

Atlantis Adventure
SSI-Skin Diving School of Atlantis. Rentals-Sales-Service. Daily dive trips-local and Bimini charters. Convenient dock space for easy air fills. Open 8:30 a.m.-7 Mon-Sat; 9 a.m.-2 Sun. 1621 SE 3rd Ct. (Cove Shopping Center), Deerfield Bch, FL 33341 (305) 426-4076, 426-4078

Professional Diving Schools of Florida
Daily diving trips and private charters-PADI 1540 N. Federal Hwy., Pompano, FL. Bahia Mar Yachting Center, Ft. Lauderdale, FL. Call (305) 761-3414

Divers Haven
Sales-Instruction-Service-NASDS instruction Scubapro-Dacor-Submarex. 1530 Cordova Rd., Ft. Lauderdale, FL 33316 (305) 524-2112

Lauderdale Diver
Sales-Service-Rental-Instruction-Travel Awarded PADI outstanding Training Facility Inflatable Boat Dealer
1334 S.E. 17 St., Ft. Lauderdale, FL 33316 (305) GO-SCUBA

Ocean Divers—Ft. Lauderdale
Your complete Ft. Lauderdale dive facility. U/W Photography our specialty. Sales-Service-Rental-Repairs-Dive outfitting for launches. 4370 N. Federal Hwy., Ft. Lauderdale, FL 33308. (305) 491-7723

Dixie Divers Inc.
The Treasure Coast Professional Dive Shop Sales-Instruction-Rentals-Repairs-Air. Local, Keys, Springs & Island Trips.
1717 South US1, Ft. Pierce, FL 33450. (305) 461-4488

Allen's Aquatic & Trail Center
Sales-Service-Inst.-Air-Scubapro-Dacor-U.S. Divers-Farallon-Ikelite-Bayley.
99 SW 34 St., Gainesville, FL 32607 (904) 373-9233

Tarpoon Diving Center-Kevorkian, Inc.
Speargun specialists, Mfrs. of rubber slings, exporters of major brands, Instruction, Full service. 3200 Palm Ave., Hialeah, FL 33012 (305) 887-8726

Ginnie Springs
Beautiful diving year round—6 crystal clear springs, 72°. Complete camping facilities. Dive-shop-air-rentals. Six miles west of High Spings on S-236. Rt. 1, Box 153, High Springs, FL 32643 (904) 454-2202

Abel's Tackle Box
The personal place to dive in the Keys-2 boats-daily reef trips-Sales-Air-Rental-We welcome families and beginners.
MM 84½, Islamorada, FL 33036

Channel 2 Boat Rentals
Rental boats available—16', 20'. Snorkeling, diving, reef trips aboard the Winter Hawk with Capt. Pete Ross. Located at Caloosa Cove Marina, P.O. Box 446, MM 73½, Islamorada, FL Keys 33036. (305) 664-4455

Holiday Isle Dive Center & Resort
Reef trips-Air-Rentals-Beautiful resort and tiki bar. Upper Keys, MM 84½ Overseas Hwy., Box 482SP, Islamorada, FL 33036. (305) 664-4145

The Reef Shop Dive Center & Charter Service
Rentals-Sales-Repair-Air-Day/night reef trips 2 dive boats-Club/group packages and PADI instruction. Rt. 1, Box 7, S.D.M.,Islamorada, FL 33036. (305) 664-4385

Aquifer Dive Center, Inc.
Offshore Jacksonville Charters-NAUI-PADI-YMCA-Specialty trips-Complete sales-Service-Repairs-Air-Advance and cave diving instruction. 4564 Atlantic Blvd., Jacksonville, FL 32207. (904) 398-1274

The Scuba Shack
Rentals-Air-Instructions-Trips-Repairs
2485 N.E. Dixie Ave., Jensen Beach, FL 33457 (305) 334-8808

New England Divers, Inc.
9818-9820 S. Dixie Highway, Kendall, FL 33156. (305) 667-4622 or 4623

American Diving Headquarters
Charters to Pennekamp Park-3 Boats-Group and multiple rates available-Air-Sales-Service-Rentals-Repair-Motel Reservation-Scuba Instruction. MM 106, Rt. 1, Box 274-B, Key Largo, FL 33037. (305) 451-0037

Bill Crawford's Tropic Isle Dive Shop
Reef Trips-Air 5000-Rentals-PADI Inst. Dive Pennekamp. P.O. Box 755, Key Largo, FL 33037. (305) 451-1063

Capt. Slate's Atlantis Dive Center Inc.
First dive facility in Pennekamp Park-Daily Pennekamp trips-Rentals-Air-Motel. Group rates, Dive aboard new 40' custom boat. MM 106½, 51 Garden Cove Drive, Key Largo, FL 33037. (305) 451-3020

Divers' World of Key Largo
Daily reef trips-Rentals-Air-Sales-Instruction. Located at Rock Harbor Marina.
P.O. Box 1663, Key Largo, FL 33037 (305) 852-5498

Holiday Inn Hotel
Super dive with Capt. Bob Klein. Cay Sal trips all summer. Pennekamp Park all winter aboard the 50' *Plus Ultra*. MM 100, Key Largo, FL 33037. (305) 451-DIVE

Key Largo Diving Headquarters
Reef trips-Air-Rentals-Dorms-Motel-Group rates-Cay Sal & Bahama trips
Rt. #1, Box 293, Key Largo, FL 33037
24-hour hot line (305) 451-1151

Pennekamp Park Concession
Free brochure, 25¢ for reef map.
P.O. Box 13-M, Key Largo, FL 33037
Group charters available. Call or write today: (305) 451-1621

Quiescence Diving Service
Personalized Instruction and Charters. Dive Pennekamp Park uncrowded. Key Largo Kampground, Box N-13. Key Largo, FL 33037. (305) 451-2440

Goodtime Divers/Bryn Mawr Resort
Family operated dive and snorkel charters-Shell collecting-Night dives our specialty. Our family dives with your family.
MM 95, Key Largo, FL 33037
(305) 852-3002

Sea Trail Motel
Budget rates-TV-AC-refrigerators-custom dive and snorkel trips-29' Owens-6 divers max.-Rentals-Pennekamp trips. Rt. 1, Box 91, MM 98.5, Key Largo, FL 33037
(305) 852-8001

Stephen Frink Photographic Service
Key's most complete U/W photo facility-Camera rentals-Repairs-Service-Instruction-24 hr. Film Processing-Commercial photography-Located in Ocean Divers MM 102½. P.O. Box 1907, Key Largo, FL 33037. (305) 451-3737

Steve Klem's U/W Guide Service
We dive with you-Capacity six divers-Exciting fish feeding tours-Check out dives by appointment. P.O. Box 1803, Key Largo, FL 33037. (305) 451-1831

Sundivers Station
Pennekamp reef trips-Instruction-U/W photography-Dockside Air-Rentals. Located at Deep 6 Marina, MM 104.
Rt. #3, Box 289-A, Key Largo, FL 33037
(305) 451-0676

Angler's Dive Shop
17', 19' Dive Boat Rentals-Small group specialist-Reef trips-Sales-Service-Rental-Repair-Air-Hydros
US #1, Stock Island, MM 5, Key West, FL 33040. (305) 294-4248

Key West Pro Dive Shop, Inc.
1605 N. Roosevelt Blvd., Key West, FL 33040 (305) 296-3823. Air-Sales-Repairs-Instructions Daily reef trips-Charters to Dry Tortuga, specializing in group charters.

Reef Raiders Dive Shop—Capt. Franco
2 daily reef trips-Dry Tortugas.
109 Duval St., Downtown Key West, MM 4½, Stock Island, Key West, FL (305) 294-0660; (305) 294-3635

The Aqua Shop
Palm Beach diving at its best. Palm Beach's newest pro shop-NASDS-Sales-Service-Repair-Rentals-Bahamas trips. 1408 10th St., Lake Park, FL 33403. (305) 848-9042

Atlantic Coast Divers Inc.
Complete pro shop-hydro-tumble-repair custom spring steel shafts-Machine shop-Pro spearfishing and collecting 409 Lake Ave., Lake Worth, FL (305) 582-0877

Fred & Pam's Atlantis Marina
Boat rentals to the reef-Camping-Motels-Air-Rentals-Trips-Complete dive service
P.O. Box 966, Long Key, FL 33001
(305) 664-4318

Diver's World, Inc.
On Florida's West Coast
57' Charter Dive Boat-PADI Inst.
13613 Gulf Blvd., Madeira Beach, FL 33708 (813) 771-7593

The Diving Site Pro Dive Shop
Daily Reef Trips-Sales-Rentals-Repairs-Hydro testing. 40' and 34' dive boats. MasterCharge and Visa.
12399 Overseas Hwy., Marathon, FL 33050 (305) 289-1021

Hall's Diving Center & Motel
Reef trips-Rentals-Instruction-5000 psi-7-day instructor training courses-9 a.m. to 6 p.m., 7 days/week. 1688 Overseas Hwy., Marathon, FL Keys 30050. (305) 743-5929

Hurricane (Sunshine Key) Aqua Center
Dive Looe Key, daily or overnight trips-Fast new 64' aluminum boat-Chase boat-5000 psi-Air-New location-Motel-Restaurant-Marina. 4650 Overseas Hwy., Marathon, FL 33050. (305) 743-2400

Missile Skin Diving
PADI/YMCA Instruction-Weekend trips Rentals-Air. Come dive with us.691 N. Courtney Parkway, Merritt Island, FL 32952. (305) 453-0600

Calypso Dive Center
Sales-Service-Rentals-Air fills-Inst.-Trips. 10 minutes from airport. Se habla espanol. 8449 S.W. 40th St., Miami, FL 33155 (305) 553-3570

Diver's Den South
Sales-Service-Rentals-Trips-PADI-NAUI-YMCA Inst. 12614 N. Kendall Dr., Miami, FL 33186. (305) 595-2010

New England Divers, Inc.
2945 N.E. Second Ave. Miami, FL 33137 (305) 573-4600

The Diving Locker
20 passenger Coast Guard approved diving boat. Sales-Service-Air-Rentals-All major brands. Instruction private & group-NASDS. 295 Sunny Isles Blvd., Miami Beach, FL 33160. Open 7 days 9 a.m.-10 p.m. (305) 947-6025

Atlantic Coast Divers Inc.
Complete pro shop-Hydro-Tumble-Repair Custom Spring Steel Shafts-Machine Shop Pro Spearfishing and Collecting 409 Lake Ave., Lake Worth, FL (305) 582-0877

Pisces Divers, Inc.
Your full service dive facility in North Dade. Service-Sales-Trips-The best instruction 14328 Biscayne Blvd., N. Miami, FL 33181 (305) 944-2310

Mathey's Aquatics Unlimited
Host to Fla. Springs/Bahamas. Scubapro-Dacor-Cressi-SAS-Swimaster-US Divers-Ikelite, NASDS Facility. Open 7 days a week. 1472 Park Ave., Orange Park, FL 32073. (904) 264-3357

Jim Hollis' Scuba World
Sales-Charters-Rentals-Repairs-Air Central Florida's only 5 star Training Facility. 5107 E. Colonial Dr., Orlando, FL 32807 (305) 273-3373

Hal Watt's Scuba & Ski
Instr.-Sales-Rentals-Repair-Guides-2215 E. Colonial Dr., Orlando, FL 32807 (305) 896-4541

Scott's Swim & Scuba Center
Underwater photo headquarters-NAUI-PADI-YMCA-Scuba & swim lessons-Private and Group-Charters to Bahamas, Cuba, Cozumel. 3465 Edgewater Dr., Orlando, FL 32804. (305) 425-8811

Ft. Lauderdale Divers, Inc.
Personalized scuba & U/W photo classes. Scubapro, Subsea, Submarex, SSI Instr. 33 E. Acre Dr., Plantation, FL 33317 Write or call today: (305) 791-2082

Nautilus Dive, Surf & Ski
Open 7 days/week. Rentals-Air-Instruction-Trips-Repair. 2700 E. Atlantic Blvd., Pompano Beach, FL 33062. (305) 943-DIVE

Vortex Springs
Sales-Service-Rentals-3000 PSI Air-Camping RV Hookups-Excellent Visibility yr. round-Cave/Cavern Diving-Compressor/Cascade sales. Rt. #2, Box 18A, Ponce de Leon, FL 32455. (904) 836-4979

Frank's Dive Shop
Daily reef trips on 48' custom dive boats-Air-Sales-Service-Scubapro-Dacor. Come join us for full day of diving. 301 E. Blue Heron Blvd., Riviera Beach, FL 33404. (305) 848-7632

SEAPRO Scuba Center
Dive Palm Beach—37' custom dive boat. Instruction-Air-Rentals-Repairs-Sales. 3619 Broadway, Riviera Beach, FL 33404 (305) 844-DIVE

Florida Scuba Diving Institute, Inc.
Sales-Service-Air-All levels PADI Instr.-Olympic Pool-Private Club-Saunas-Showers. 1010 S. 76 St., Tampa, FL 33619 (813) 626-DIVE

The Dive Shop, Inc.
Diving gear and instruction-Surf shop-Hobie sail boats-Trips in Florida to the Bahamas. 1325 Washington Ave., Titusville, FL 32780 (305) 269-4630

Divers World Undersea Center
Daily boat trips-1 and 2 tank dives-Full service. 2525 Lake Drive, Riviera Beach, FL 33404; (305) 844-1510

GEORGIA

Berry Atlanta
Air-Rentals-Repairs-Instruction. Just a few minutes from I-75—I-85 or Airport. 3441 Stewart Avenue, Hapeville, GA 30354 (404) 766-1186

Diving World USA
Largest Dive Shop in GA-All brands-GA's Recompression Chamber (3 man)-YMCA Classes-Rental-Repair. 2945 Buford Hwy. N.E., Atlanta, GA 30329. (404) 634-4354

Dive and Leisure Sports
PADI Training Facility-Monthly Dive Trips. 3365 Main Street, College Park, GA 30337 (404) 767-1815

Garrard Pro Divers
PADI-5 Star Training facility. 2552 #7 South Cobb Dr., Smyrna, GA (404) 432-5574

Sub-Aqua Specialties
Sales-Service-Rentals-PADI Inst.-Heated Pool-5000 PSI Air-Fla. Diving Information. 2236 Bemis Red., Valdosta, GA 31601 (800) 841-4443; GA (800) 342-7156 Alaska, Hawaii, Puerto Rico, BVI (800) 841-5000

HAWAII

Aloha Dive Shop
"Gateway to Hanauma Bay"
Retail Sales-Service-Air-Rentals-Charters-Boat & Shore Dives-Inst. Koko Marina, Hawaii Kai, HI 96825. (808) 395-5922

South Seas Aquatics
Boat and shore dives and instruction. 1125 Ala Moana Blvd. Honolulu, HI 96814. (808) 538-3854

Waikiki Diving, Inc.
Waikik's only full service dive shop. Air-Rentals-Repairs-PADI Instr.-Boat Charters-Courtesy car-Multi-lingual instr. 420 Nahua St., Honolulu, HI 96815; (808) 922-7188

Aaron's Dive Shop, Inc.
Plane wreck-Charters-U/W Scooters-Shelling-Our guides capture your dive on film-NASDS-Full Service Store-Instruction. 39 Maluniu Ave., Kailua, HI 96734 (808) 261-1211

Central Pacific Divers
Daily Charters to the Best Diving on a choice of 6 islands-Sales-Charters-Instruction. 780 Front St., Lahaina Mani, HI 96761

Dive Makai Charters
Not Kona's Biggest—Kona's Best Small personal charters-You are boss Tom Shockley/Lisa Choquette, P.O. Box 2955, Kailua-Kona, HI 96740 (808) 329-2025

Gold Coast Divers
Steve & Sandy Kaiser invite you to try the finest diving the Kona Coast has to offer. 5 day NAUI certification-Open 7 days P.O. Box 2064, Kailua-Kona, HI 96740 (808) 329-1328

Ocean Adventures, Inc.
Complete underwater specialists-2 custom dive boats-Daily tours-Sales-Rentals-Air-Repair-7 days. 46-216 Kahuhipa St., Kaneohe, HI 96744. (808) 235-5867

Skindiving MAUI
Charters-Sales-Rental-Air-Photo equipment-Certified Instruction PADI-NAUI. 1993 S. Kiheird, Kihei, HI (808) 879-1502

Sea Sage Unlimited
"Kauai's Only Complete Pro Dive Ctrs." Get wet safely with us. Within 15 min. of your hotel. 4544 Kukui St., Kapaa, HI 822-3841; Poipu 742-1262; Hanalei 826-6180

Lahaina Divers, Inc.
"Lahaina's Quality Dive Store". Daily Charters-Sales-Instr. Recommended by Undercurrent. 710 Front Street, 96761; (808) 661-4505

ILLINOIS

Anchor In Scuba Centers
Fast, 3-day repair service. Camera rentals and sales (photo shop). 315 W. Ogden Ave., Westmont, IL 60559; (312) 917-1060. 6932 W. 16 St., Berwyn, IL 60402; (312) 484-1018

Berry Scuba Co.
Sales-Service-Rentals. 6059 W. Addison, Chicago, IL 12003; S. Cicero, ALSIP; 1717 Rand Rd., Palatine-Instructions. (312) 725-2032

Academy Aqua Sports Dist. Ltd.
Air-Sales-Service-Instruction 2838 Chicago Rd., S. Chicago Hts., IL 60411 (312) 756-4334

Underseas Scuba Center
626 N. Addison Ave. Villa Park, Ill 60181

Midwest Diving Specialists, Inc.
Dacor-Global-Ikelite-Imperial-Poseidon-White Stag-PADI Inst.-Air. 203 S. Linden, Normal, IL 61761. (309) 452-0222

Scuba Systems
PADI Instruction, in-store pool, sales and discount prices on most popular brands. Air-Service-Rentals-Repairs. 3919 Oakton St., Skokie, IL 60076 (312) 674-0222

INDIANA

Aqua Sports Unlimited
PADI 5 Star Training facility. Light salvage, commercial work, sales & repairs. Local and Fla. Keys trips. Int'l travel. Open 9-5 Mon-Thurs., 9-7 Fri., 9-5 Sat. 1613 S. Lodge, Evansville, IN 47714. (812) 437-3483

Aqua Pro Scuba Center
Dacor-Seapro-SAS-Sales-Service-Instruction NASDS-Trips-Air-Group rates 51400 US 31 North, South Bend, IN 46637 (219) 272-8607

KANSAS

Scuba World, Inc.
Air-Sales-Rentals-Service & Instruction PADI-NAUI-Dive trips. 2055 SE 29, Suite B, Topeka, KS 66605 (913) 266-7300

Topeka Dive Shop,Inc.
Complete Pro Dive Facility Service-Sales Rentals NAUI-PADI 19 yrs. experience in diving 3032 E. 6th St. Topeka, Kansas 66607

KENTUCKY

Lexington Dive Shop, Inc.
819 Euclid Ave., Lexington, KY 46562 (606) 266-4703

Louisville Dive Shop, Inc.
2478 Bardstown Rd. Louisville, Ky. 40205 (502) 458-8427

Dale Hollow Lake Dive Shop
Sulphur Creek Marina & Campground, Inc. Kettle Ky. 42752 (502) 433-7272 or 433-7200 Kentucky's Most Complete Scuba Facilities

LOUISIANA

Aquatic Dive Shop
PADI-NAUI-Sales-Service-Rentals-Instruction (continuing education with variety of specialized courses). Int'l travel. Open 10-6 Mon-Sat.
1903 Johnston St., Lafayette, LA 70503
(318) 233-2927

Aqua Tech Dive Center
Quality at a discount! Sport and commercial sales and repairs.
6119 Westbank Expressway, Marrero, LA 70072. (504) 341-DIVE

Harry's Dive Shop, Inc.
Skin-Scuba-Commercial Equip.-Sales-Service-Repairs-Airfills-USCG Cert. Dive Boat.
4709 Airline Hwy., Metairie, LA 70001
(504) 888-4882

Adventure Sports
NAUI-YMCA-PADI Instr.-Home of ARK-LA-TEX Diving School Inc. & U/W Swim Assoc.-Sales-Repairs-Rentals-Air-Trips.
1817 Texas Ave., Shreveport, LA 71103
(318) 425-5870

MARYLAND

Divers Den, Inc.
Maryland's Oldest Dive Store
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(301) 655-8744

Port Hole Dive Shop
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The Scuba Hut, Inc.
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Instruction-Charters-Travel-Service
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(301) 761-4520

Sea Colony Dive Shop
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New England Divers, Inc.
Tozer Rd., Beverly, MA 01915;
(617) 922-6951. 236 Wood Road, Braintree, MA 02184; (617) 848-4990

Ship Mate Dive Shop
PADI Instru.-Sales-Rentals-Charters-Air. Sailboat rentals & Beach diving.
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(617) 251-4895

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(617) 331-5375

New England Divers, Inc.
11009 First Ave., South Seattle, WA 98168
(206)246-8156

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Lake Orion Divers Den
Air-Sales-U/W photo-PADI-NADI-Instruction-Dacor-Poseidon-Other major brands. Light salvage. Lake Orion, MI 48035; (313) 693-2131

Scuba North, Inc.
NAUI-PADI-Retail/Wholesale-Repairs-Hydro-test-Lessons-Charters-Rentals-Sailboats-Windsurfing-Compressors. 13258 W. Bayshore Dr., Traverse City, MI 49684;
(616) 947-2520

SPUD'S Underwater Outfitters
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(313) 363-2224

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6060 5th St., NE, Minneapolis, MN 55432
(612) 571-9003

Scuba Center
Equipment-Instruction-Repair-Dive Trips-U/W Photography. 5015 Penn. Avenue S, Minneapolis, MN 55419. (612) 925-4818

The Argonautes, Inc.
NAUI-PADI-All lines-Charter lake/sea-5000 psi. 1040 University Ave., St. Paul, MN 55104
(612) 645-0831

Club Scuba, Inc.-Pacific/Caribbean Travel
Instruction-Basic-Advanced-U/W Photo-Full service in repair-Hydro.
East-2280 Maplewood Dr., Maplewood, MN
West-1300 E. Wayzata Blvd., Wayzata, MN
(612) 484-7252 or (612) 473-4266

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Sales-Service-Rentals-Instruction-Heated Pool-PADI Training Facility. 1300 W. 40 Highway, Blue Springs, MO 64015. (816) 229-0855

Hughes Dive Company
Sales-Service-Air-Rentals-Trips-Inst.-PADI & SSI-Visual Inspection-Hydros.
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(314) 335-0756

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(314) 822-3005; 11215 Nat. Bridge Rd., St. Louis, MO 63044. (314) 731-5003

Divers Village, Inc.
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(702) 323-0353

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Wolfboro, NH 03894
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(201) 887-0194

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(609) 924-4240

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(716) 875-6528

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(919) 475-2516

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(803) 787-8222

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Air-Reg. & Valve Repairs-Hydros Wholesale & Retail-H.P. Air Compressors-New-Used-Rebuilt. 145 Cherry St., Burlington, VT 05401. (802) 862-0963

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Aqua-Lung Diving Center, Inc.
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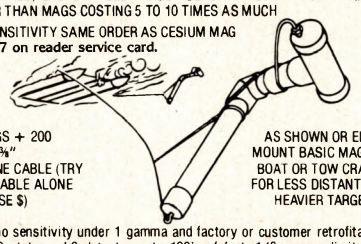

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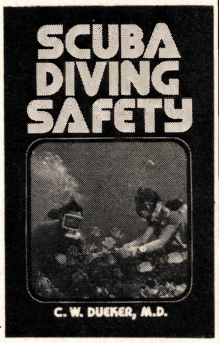
REVIEWS

by Kathleen McHugh

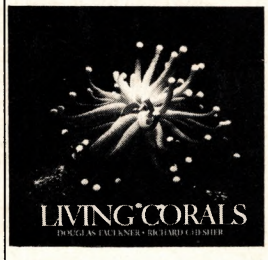


Scuba Diving Safety

C.W. Dueker, MD; World Publications, PO Box 366, Dept. A., Mountain View, CA 94042; Softbound; 132 pages; $3.95

Commercial diving on North Sea oil rigs is inherently dangerous. But recreational diving isn't, if practiced properly, according to Dr. Dueker. He is concerned about the high incidence of accidents in sport diving and his book presents a basic, sensible guide to safe diving techniques. He feels that most diving accidents can be prevented with proper attention to rescue and resuscitation procedures.

Beginning with a checklist for safe diving, the book covers drugs and diving, panic and how to deal with it, first aid techniques, rescues and resuscitations, barotrauma, emergency ascents and explanations of decompression, nitrogen narcosis and oxygen poisoning. Dr. Dueker describes the causes and effects of each of these hazards in a thorough manner, understandable to the average diver. Photos and charts aid in comprehension of CPR, mouth-to-mouth resuscitation and how to use the decompression tables.



Living Corals

Douglas Faulkner, Richard Chesher; Crown Publishers, Inc., 1 Park Ave., New York, NY 10016; Hardbound; 308 pages; $45

For pure beauty, sensuality and diversity, *Living Corals* is a masterpiece. Culled from 16 years of diving in the South Pacific, Caribbean, Red Sea and waters surrounding Australia, Vancouver Island and Florida, the 194 photos encompass 34 coral families, taxonomically ordered, in a large, cloth-bound, glossy-paged format.

Faulkner, the "photographer-laureate" of corals, captures the odd and unique, the

colorful and colorless. Primordial configurations disolve into raspberry mounds and ocher grooves. Subaquatic flower gardens burst in lavender, peach and azure wonder while burnt orange sea pens await a wet wit. This Oz-like underworld goes on and on.

But the work is more than just a coffee-tabler. The text of Dr. Richard Chesher, a zoologist and marine biologist, complements and enhance the photographs with a lucid and fascinating narrative of the coral's life cycle, types of corals, and their evolution. The book is additionally valuable since many of the specimens illustrated have been catalogued by Dr. Frederick Bayer and reside in the permanent collection of the National Museum of Natural History in Washington D.C.

Faulkner's own photo captions, including common and scientific tags, site, depth, date and a diary of the coral's lifestyle are found at the end of the volume, where he could be more explicit. I only wish some common name or identification besides a numeral appeared by each photo.

Living Corals is available for $25 from: Sport Diver Books, PO Box 2008, Lakewood, NJ 08701. Allow 4-6 weeks for delivery.

How To Find Your Way

Jim Foley; Dacor Corp., 161 Northfield Rd., Northfield, IL 60093; Softbound; 91 pages; $4.95

This handbook is subtitled: A Complete Guide to Underwater Navigation. It should be called the Schlock Guide to Underwater Navigation. Granted topics like ice, wreck and night diving and search and recovery techniques aren't normally covered in basic scuba. But what *is* of value in this Dacor promo guide could be boiled down to three or four chapters instead of ten. And if large type, fuzzy photos, blank pages and useless drawings aren't bad enough, there are full pages devoted to divers barbecuing or to showing off Dacor equipment.

To the author's credit, the chapters on magnetic variation, ice, wreck and limited visibility diving are informative, if short. The rest reads and looks like it was thrown together overnight for a ninth grade science project. Dacor, stick to what you do best, manufacturing and leave the instruction to those who can write.

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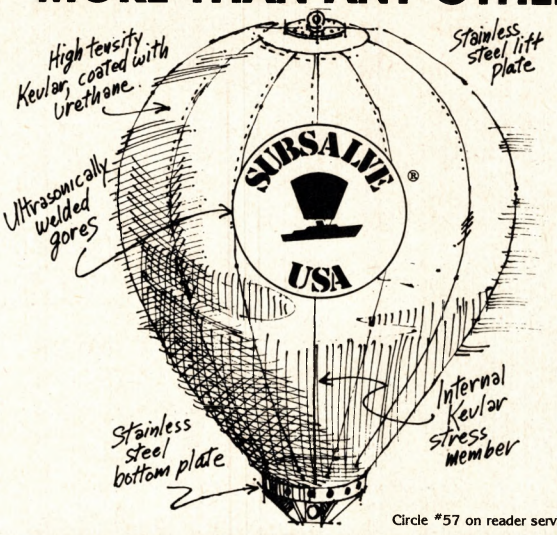

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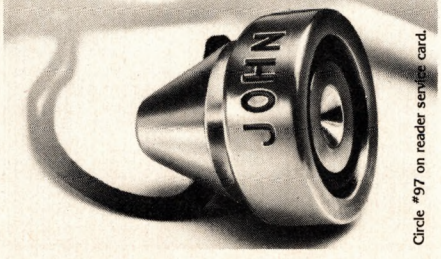

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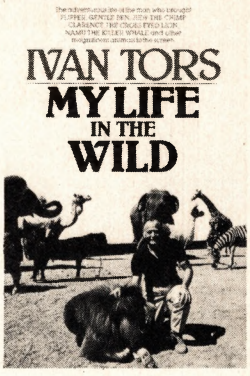


My Life in the Wild

Ivan Tors; Houghton Mifflin Co., 2 Park St., Boston, MA 02107; Hardbound; 209 pages; $10.95

Ivan Tors has spent most of his life training, filming and learning about animals, and not your average garden variety: hippos and lions, crocs and whales, snakes and sharks, bears and baboons. Tors finds something appealing in all critters, no matter how wild. In his travels he has lived with desert nomads, worked with Judy Garland and Greta Garbo and studied with renowned scientists like Dr. Louis Leakey, but he only feels at home with his animals.

Unlike Dr. Doolittle, he doesn't simply *talk* with them, but observes and *understands* them. Even his sons' and his own mishaps with various creatures are written off as "lessons" they learned about nature, or how animals act when threatened, hurt or frightened, never the result of the animals' hostility. Through this set of eyeglasses, Tors sees African hunting dogs as "unselfish," elephants as "socially organized" and dolphins as "logical."

Although not a traditional autobiography, Tors' uplifting tale is full of personal anecdotes, adventures and near clashes with death. For the 007 thriller *Thunderball* he swam through a pool of tiger sharks to show Sean Connery how it's done. He once spent nine hours in a tree with his photographer, Sven, to capture a herd of elephants at a water hole. Tors also lived with the Camel People in Gabra, Africa during a devastating seven-year drought. With each adventure his knowledge of the nature of animals grew, as did his understanding of the nature of man.

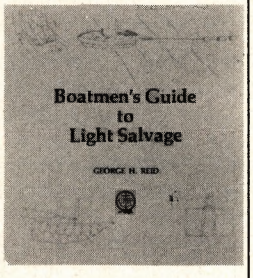
Of special interest to divers are the chapters on dolphins (and how Flipper saved his life), sharks and killer whales. It's a diary replete with Tor's insatiable curiosity and affection for animals. As an animal trainer, behaviorist, writer and ecologist, he feels that all inexplicable animals puzzles can be solved if we only understand their true natures. His love and attraction for animals is contagious.

This is Diving

Dulio Marcante; Sail Books Inc., 38 Commercial Wharf, Boston, MA 07753; Hardbound; 144 pages; $13.95

Anyone can plunge into the water, but to dive well, one must have a good grasp of the physical and physiological phenomena which affect the diver and stay within those limits. This colorful introduction to scuba is aimed at providing a clear and accurate picture of the techniques of safe diving and their scientific bases. It is intended for the beginner, indicating the scope of initial exploration and the range of activities open as he gathers skill and experience.

Originally written in Italian, this diving manual is illustrated with colorful drawings and diagrams which do as much toward comprehension of the physics involved as the text. It covers the basics of scuba and snorkel diving, power swimming, principles of breathing, rules governing underwater safety, body training, use of equipment, flora and fauna and first aid procedures.



Boatmen's Guide to Light Salvage

George H. Reid; Cornell Maritime Press Inc., PO Box 109, Cambridge, MD 21613; Softbound; 72 pages; $5

With more boats on the high seas and the value of nautical apparatus inflating daily, commercial light salvage can be a very profitable sideline. This handbook gives the skilled boatman/diver the basics to enter this lucrative market. Capt. George Reid writes: "I do not wish to destroy a myth, but salvage work mainly consists of carrying on commonplace activities under unusual circumstances." There are many 'tricks of the trade' and salvors are often reluctant to disclose them but Reid lets us in on a few. In laymen's terms he describes the basic skills and gear required for salvaging, troubleshooting techniques, tow riggings, quick patchings and a few legal considerations in light salvage work.

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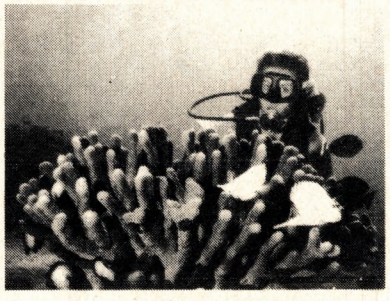

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CALENDAR

July

1 **1980 Sport Diver U/W Photo Contest**
You've got less than 50 days to shoot, develop and submit entries to our annual underwater photo competition. Open to amateurs only, the contest has eight categories: saltwater color and b/w, freshwater color and b/w, fixed-focus color and b/w, creative photography and fresh or saltwater movies. Deadline: August 16, 1980. Submit your work to: U/W Photography Contest, *Sport Diver* Magazine, 444 Brickell Ave., Suite 250, Miami, FL 33131.

1-4 **Reef Appreciation Course**
The YMCA Underwater Activities Center will sponsor a Reef Appreciation Course in conjunction with Texas Christian University. Contact: Rena Bonem, Geology Dept., Texas Christian University, Fort Worth, TX 76129.

4-6 **Cave Diving Awareness for the 80 s**
Future cavers are invited to a weekend of discussions sponsored by the National Association for Cave Diving to include: safe caving, buddy communication, special equipment, conservation, avoiding silt, reel and line techniques. Advance registration, $7.50; at the gate, $10. Contact: Bob Tyson, c/o NACD, Box 1518, High Springs, FL 32643.

14-26 **Diving Medicine in Depth**
Journey to Palau in Micronesia to attend this basic program for physicians interested in the medical and physiological aspects of diving and diving safety. In-depth material will be presented in lecture, seminar and practical sessions. Contact: Program Coordinator, Dept. 1260, Human Underwater Biology, Box 5893, San Antonio, TX 78201.

19-20 **Pacific Coast U/W Photo Contest**
The San Diego Council of Divers and Leach Photo Systems will sponsor this photo competition to be held at the San Diego-La Jolla Underwater Park. Divisions include novice, amateur, semi-pro and pro and 32 awards will be given in three categories. All photographers will shoot one roll of film in the park during a specific time. Registration includes film, developing, judging, awards, a party and special equipment drawing. Advanced registration: $15; day of contest, $25. Contact: San Diego Council of Divers, Inc. Box 9259, San Diego, CA 92109 or Leach Photo Systems, Box 75, Keno, OR 97627.

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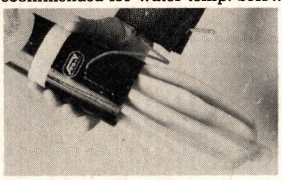

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26-27 **Devil's Lake Photo Course**
A two-day instructor course will be taught by veteran underwater photographer, diver and teacher, Dick Jacoby. The course will emphasize the theory of participatory learning, slide processing, AV presentations and marketing concepts. Participants must be 18 years old and certified. Tuition, $149, includes photo equipment. For details, contact Dick Jacoby, 4915 Pershing Rd., Downers Grove, IL 60515.

August

28-Aug 10 **Coral Reef Ecology Program**
Diving science teachers interested in expanding their scope of marine identification and principles and concepts of coral reef ecology are invited to attend this two-week seminar. A week of preparation at the Florida Institute of Technology campus in Melbourne will be followed by a week of extensive field work including three dives daily to study a variety of reefs and fish populations. The course offers five college graduate credits. Contact: Dr. Robert Fronk, Science Education Dept., Florida Institute of Technology, Melbourne, FL 32901.

1-3 **PID Second Treasure Hunt**
People Interested in Diving and the Sunken Treasure Dive Shop will sponsor this mid-Pennsylvania treasure hunt with up to $15,000 in prizes including a trip for two to the Cayman Islands. Activities will include a social, the treasure hunt, a banquet, an inner tube race down the Susquehanna River and a barbeque. For details, contact Rich Best, Sunken Treasure Dive Shop, Rd. 4, Jersey Shore, PA 17740.

20-Sept. 9 **Pacific POS Expedition**
Accompany Jean-Michel Cousteau and the Project Ocean Search staff to either the Coral Sea or Bismarck Archipelago, off Papau New Guinea. Participants will have unequaled opportunities for diving and exploring the lush marine environments of these isolated islands and contact with peoples unaffected by the problems of modern society. Cost: $3850, includes activities, room and board and round-trip air fare from Los Angeles to New Guinea. Contact: POS, The Cousteau Society, 930 West 21st St., Norfolk, VA 23517.

23-Sept. 1 **MD Dive-A-Thon**
The San Diego Council of Divers and Sunset Pools will attempt to set a new world record for continuous underwater Yatzee of 216 hours and raise $10,000 for Muscular Dystrophy. All certified divers are invited. Contact: San Diego Council of Divers, Box 9259, San Diego, CA 92109.

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I Learned About Diving From That

Just because it looks good doesn't mean it is.

BY DEE MOSTELLER

It was one of those perfectly gorgeous days with solar energy pouring out of the sky unhampered by clouds or pollutants. My buddy and I were camping at Big Tub Lodge in Tobermory, Ontario and had just emerged from sleeping bags ready for our first dive on the famous Georgian Bay shipwrecks.

In the early morning it was quite cool, but as the day wore on it got to be downright hot even among those tall, cool pines. By the time we reached G&S Watersports' dive boat, the *Huron Brave*, we thought of taking our 3/16-inch jumpsuits rather than the hard-to-don, quarter-inch, skin-on-skin farmer johns we normally used in Great Lakes diving. But my buddy, being older and wiser in the ways of diving, decided we should leave the Caribbean suits at home despite the obvious heat.

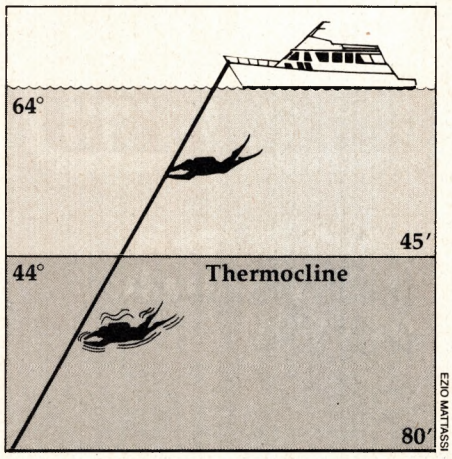
We cooled off considerably on the way to the *Scoville*, the day's first destination. Upon arrival the old finger-in-the-water test found the temperature to be reasonable—on the surface. It also appeared to be quite clear as we could see one end of the sunken vessel in 60 feet of water, with the nether end sloping down to about 80 at the base.

Good, sound ingredients for a sport dive: not too deep, not too shallow; nice visibility; relatively warm water. I considered leaving my hood and gloves behind, but my partner persuaded me to put the bonnet on and carry the gloves tucked into my jacket.

So, over the side, slowly starting to descend feet first. The surface water turned out to be a nippy 64 degrees, and the chill immediately started seeping in through the suit seams and neck gaps, torching little nerve spots on my body.

The slow descent didn't satisfy my buddy. He tucked his head down and headed for the wreck. I followed. At about 45 feet what felt like a blast of cold air—something akin to a giant air conditioning unit being turned on suddenly—slugged me right in the chops, leaving the exposed lips and chin numb. Involuntarily I put a hand out in front of me to see what the source of the sudden chill was. That poor, bare extremity turned into a block of ice.

I stopped ten feet short of the *Scoville* and began to put my gloves on, when my buddy noticed me and came back up. I wrapped my arms around my



body—our signal for "I'm freezing my tush off"—and he showed me the thermometer. The needle wavered around 44 degrees — 12 above freezing and 53 below my normal body level. We had lost 20 degrees from the surface to 40-odd feet. Pain and confusion.

I was fairly new to diving, and had been limited to relatively stable-temperature waters, both cold and warm; therefore, I had no empirical knowledge of what had just happened. Of course it was a thermocline, one of those mysterious layers of warm water over cold where temperatures can drop by as much as 20 degrees within the space of a few inches. I'd heard about them as every novice diver has, but it takes an actual encounter with one to actually believe they're for real.

My buddy posed the silent question with his thumb, "Want to go back up?" I declined, with some inner reluctance, and headed to the wreck. The depth gauge was pegged at 60 as we started working toward the deeper end. Looking out all I could see was ten feet of greenish murk. Looking up, it appeared a cloud bank covered our retreat.

The exploration began at a leisurely pace with occasional pauses to fan away the silt from some rusty piece of metal or rotting wooden beam, but as it progressed we both began to move faster. Finally I stopped touching altogether and simply started squeezing my shivering body tighter and tighter.

At the bottom—80 feet—I grabbed the thermometer and was surprised to see it still hovered around 42-44. I had had the distinct impression that the water was getting even colder the farther we descended. I didn't realize that my body, not the water, that was rapidly cooling off.

We stopped to observe some bits and pieces on the sandy bottom, and I began to shiver much harder. Pretty soon I was shaking like a Quaking Aspen, and could hardly keep my arms wrapped around me. When my buddy saw that he raised his thumb; this time not as a question, but a command.

When I went back up through it, and the process of warm-to-cold was reversed, I finally understood. I had been through my first thermocline. At 20 feet my hypothermic shivering ceased, and we leveled off and swam over to the shore of a small rock island to play in the shallows. The comparative "warmth" of 64 degrees versus 44 was so great that psychologically, if not physiologically, I felt quite toasty.

Obviously, if the temperature change is drastic enough it can affect a diver adversely. One can become extremely uncomfortable in the cold, to the point of hypothermia, which can be a dangerous and debilitating condition. And not everything is what it seems at the surface. An environment may be far less comfortable and friendly than the warm clear water you met at the beginning of your dive.

Dee Mosteller is a regular contributor to ***Sport Diver*** *Magazine and editor of* ***Sport Diver's Buyer's Guide for 1980.***

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